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**TERRITORY OF HAWAII**  
**BOARD OF AGRICULTURE AND FORESTRY**

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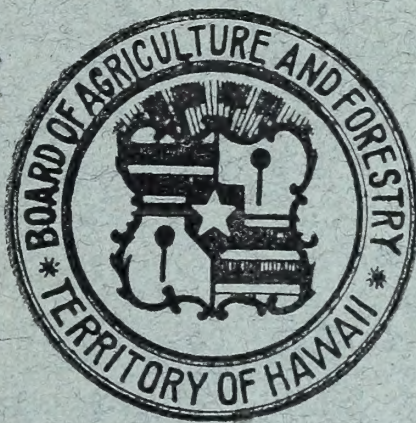
**DIVISION OF ENTOMOLOGY**  
EDWARD M. EHRHORN, Superintendent

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**REPORT**  
OF THE  
**DIVISION OF ENTOMOLOGY**  
FOR THE  
**BIENNIAL PERIOD ENDING DECEMBER 31st, 1914**

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*Reprint From the Report of the Board of Commissioners  
of Agriculture and Forestry*



HONOLULU, T.H.  
THE NEW FREEDOM PRESS.  
1915.



**OFFICERS AND STAFF**  
**OF THE**  
**Board of Commissioners of**  
**Agriculture and Forestry**  
**1913--1914**

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**DIVISION OF ENTOMOLOGY.**

**EDWARD M. EHRHORN**, Superintendent of Entomology and Chief Plant Inspector.

**D. B. KUHNS**, Assistant Plant Inspector.

**BRO. M. NEWELL**, Fruit and Plant Inspector, Hilo, Hawaii.

<b>E. E. MADDEN,</b> <b>E. R. BEVINS,</b> <b>W. D. McBRIDE,</b> <b>DR. W. B. DEAS,</b> <b>CAPT. C. F. TURNER,</b> <b>G. C. MUNRO,</b>	}	Honorary Plant Inspector at	{ Mahukona, Hawaii. Kahului, Maui. Koloa, Kauai. Hana, Maui. Kaanapali, Maui. Manele, Lanai.
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**F. SILVESTRI**, Scientific Explorer.

**D. T. FULLAWAY**, Field Entomologist.

**J. C. BRIDWELL**, Assistant Field Entomologist.

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To give information about insects free of charge is one of the duties of this division and Hawaiian readers are hereby invited to make inquiry in person and by mail. In order to be able to advise intelligently or send the right kind of useful insects for relief we like and sometimes it is indispensable for us to see the insect suspected or caught in the act, also specimens of the injury. Specimens may be sent through the mails as first class matter or by parcels post and should be put in good strong containers, so that the package won't be broken in the mail bag. A letter should accompany the specimens if possible and the package should bear the name and address of the sender in the upper left-hand corner. Address all communication: **SUPERINTENDENT DIVISION OF ENTOMOLOGY, P. O. BOX 207, HONOLULU, HAWAII.**

**EDW. M. EHRHORN,**  
Superintendent.



JUL 10 1915

**TERRITORY OF HAWAII**  
**BOARD OF AGRICULTURE AND FORESTRY**

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**DIVISION OF ENTOMOLOGY**  
EDWARD M. EHRHORN, Superintendent

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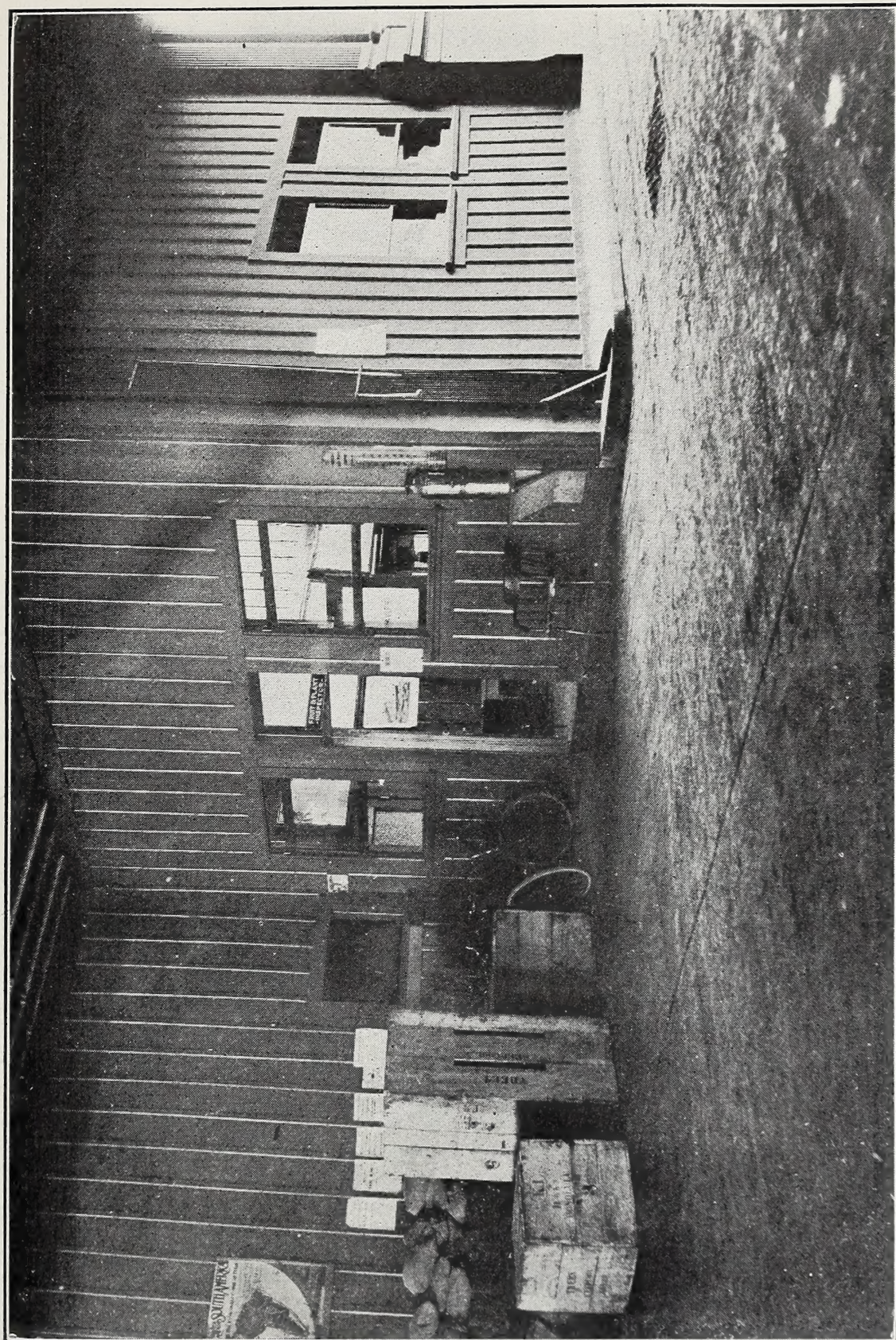


Plate 14. New Plant Inspector's Office on Pier No. 7, Honolulu, with shipment of plants in foreground awaiting inspection.







# Division of Entomology

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## Report of the Superintendent of Entomology

Honolulu, Hawaii, December 31, 1914.

The Board of Commissioners of Agriculture and Forestry,  
Honolulu, Hawaii.

Gentlemen:

I have the honor to submit herewith the biennial report of the Division of Entomology covering the work of this Division from January 1, 1913, to December 31, 1914.

The most important work of the Division of Entomology during this biennial period consisted in the inspection of all agricultural and horticultural products imported into the Territory from the mainland and foreign countries. In conjunction with this work the Territorial and Interisland inspection of all fruits, vegetables and plants was maintained, and justly so, as Honolulu, being the official port of entry for the Islands, is placed in such a position, that accidentally introduced pests can for a long period, at least, be prevented from spreading to the other Islands by a thoroughly equipped inspection force. There was also attached to this general work the search, introduction, breeding and distribution of parasites of the fruit fly and horn fly and other beneficial insects for the control of these and other pests. This work, although attached to the Division, was under the direct supervision of Mr. W. M. Giffard, President and Executive Officer of the Board of Agriculture and Forestry. This special line of work was reported on in Bulletin No. 3 of this Division, entitled "Report of an Expedition to Africa in Search of the Natural Enemies of Fruit Flies," by Prof. F. Silvestri, which report was issued on February 11, 1914, and included an account of the search, discovery, introduction, breeding and distribution of parasites on the Mediterranean and other fruit flies up to and including December 31, 1913. From January 1, 1914, until June 1st of the same year the breeding and distribution of parasites was carried on by Mr. J. C. Bridwell, the main object during this latter period being to keep alive all those species brought by Prof. Silvestri from Africa, as well as two species of horn fly parasites brought by Mr. D. T. Fullaway from the Philippines. On June 1, after ascertaining that Prof. Silvestri was



unable to secure a further leave of absence from the Italian government to make a further search for parasites in West Africa, especially the ones he failed to introduce alive on his first expedition, arrangements were made with Mr. Fullaway of the Hawaii Experiment Station to undertake the expedition under the auspices and direction of the Board of Agriculture and Forestry, Mr. Bridwell being delegated to accompany him as his assistant. During the absence of these two gentlemen the writer took direct supervision of the parasite breeding in the insectary so as to keep alive all species on hand until Mr. Fullaway's return, which was on October 27, 1914. A full account of the second expedition, including breeding, recovery and distribution on the several Island by districts of all the various parasites collected during the biennial period, is attached hereto as a special report by Mr. Fullaway, who has had charge of this work since his return from Africa. The account of the first expedition by Prof. Silvestri will be found in Bulletin No. 3 of this Division, as previously stated. By a special arrangement made between the President of the Board of Agriculture and Forestry and Dr. E. A. Back, special agent of the U. S. Bureau of Entomology, I am also able to append hereto a report by him and Mr. C. E. Pemberton, his assistant, giving the percentage of parasitism and other observations obtained while carrying on other investigations for the U. S. Government from materials collected in the field.

There have been the usual inquiries regarding pests attacking plants and it has been possible in a small measure for the Superintendent to give advice for the control of some of these whenever a request came to hand. He has also been able to visit a few localities and examine into damage done to crops by certain pests. Appended hereto is a report on those insects which have more or less given trouble during this period and such remedies which have been successfully used in their abatement.

#### STAFF.

Your Superintendent has continued as head of the Division during this biennial period, having as assistant inspector Mr. D. B. Kuhns, and as assistants on the wharves Messrs. Edward Drew, Robert W. Kanakanui and Isaac Kahere. On June 3, 1913, Mr. J. C. Bridwell was appointed assistant superintendent of entomology. On account of the unexpected arrival of Prof F. Silvestri with parasites from Africa, and finding it difficult to obtain a qualified man for parasite work here, as previously stated he was detailed for that work by direction of the Executive Officer. The services of Mr. D. T. Fullaway, entomologist of the Hawaii Experiment Station, were upon request also loaned to the Board for similar work, and the latter remained in charge of it until



October, 1913, at which time he was sent to the Philippines on research work by the U. S. Government.

Miss Agnes Buchanan was appointed as assistant in the parasite laboratory as well as Mr. Rodrigo Villaflor, their particular work being under Mr. Fullaway and Mr. Bridwell. On January 1, 1914, the work of distribution of parasites was curtailed and on my recommendation Miss Buchanan was appointed laboratory assistant under me, principally to care for the valuable collection of insects and to prepare, mount and label all insects collected, donated and taken in quarantine, also to assist in other important work when called upon. Brother Matthias Newell has continued as our regular inspector at the Port of Hilo, Hawaii, and the following gentlemen have served as honorary inspectors at the various ports on the other Islands:

Mr. E. E. Madden, Mahukona, Hawaii; Mr. E. R. Bevin, Kahului, Maui; Dr. W. D. Deas, Hana, Maui; Capt. C. F. Turne, Kaanapali, Maui; Mr. W. D. McBryde, Koloa, Kauai; Mr. G. C. Munro, Keomoku, Lanai.

#### WORK PERFORMED.

During 1913 and 1914 a decided increase in the arrival of horticultural products as well as a material increase in the number of vessels entering the Territory has been noted, especially since the opening of the Panama Canal. The inspection of fruit, plants, vegetables, also of rice, beans and other cereals arriving as freight, express packages, through the U. S. mail, and in the baggage of the travelling public has kept the force very busy.

During the biennial period the superintendent and his assistants including the Port of Hilo, boarded and inspected 1113 vessels and found 681 of these carrying vegetable matter consisting of 628,725 packages. Of this amount 606,222 packages consisted of fruits and vegetables imported from the mainland as food for home consumption; 8090 packages were seeds and 14,413 packages were plants. From these shipments on account of infestation by insect pests or plant diseases, 1,777 packages were destroyed by burning, 14,521 packages were fumigated before delivery, and 776 packages were returned to the shipper.

#### RICE AND BEAN SHIPMENTS.

The enormous consumption of rice and beans by the Oriental population of these Islands has created a great movement in these commodities from the Orient into the Territory, which apparently is increasing annually. All shipments of rice and beans are constantly watched and are carefully inspected not only for the rice weevil (*Calandra oryzae*), which species already exists on the Islands, but more especially for the rice moth (*Paralipsa mo-*



*desta*), a very serious pest of stored rice and beans not as yet introduced. All rice shipments destined here are fumigated at Kobe, Japan, under Rule III. of the Board of Agriculture and Forestry, and I am pleased to say that of the total shipments of 602,375 bags of rice and 50,535 bags of beans inspected we only found 3,400 bags of rice and 162 bags of beans which had to be fumigated on account of infestation by the rice moth.

The rice moth (*Paralipsa modesta*) attacking bean shipments came to our notice during 1913, and I immediately requested all shippers to include beans in the fumigation order at Kobe, Japan. In this matter I had the heartiest cooperation of the consignees and of the Japanese Merchants' Association, and herewith extend to them my sincere appreciation.

About the middle of November, 1913, the Toyo Kisen Kaisha Steamship Company made Hilo a direct port of call for their South American run instead of Honolulu. This meant that Hilo would be a direct port of entry for Japanese goods, and the arrival of all kinds of freight including rice and beans. During 1913 and 1914 a number of steamers touched at Hilo and large cargoes of rice and beans were landed, but fortunately all these shipments were free from the rice pests. Precautions were taken with the first shipment lest some misunderstanding regarding the fumigation requirements had been made, and I dispatched Mr. D. B. Kuhns to Hilo to be present at the landing of the shipment. He found that the rice was clean, and that the shippers had attended to the fumigation at Kobe; the first steamer brought 6457 bags of rice and 110 bags of beans.

#### EQUIPMENT.

It is very gratifying to me to be able to report that our inspection equipment is at least very complete at the Port of Honolulu. In 1912 I drew attention to the inadequate quarters that were at our disposal for fumigating large shipments of rice (see page 120 of the 1912 report), and recommended the erection of a large house for fumigating purposes at that time. During the latter part of 1913 a very substantial building 20 x 30 feet with 12 foot ceiling has been built on Kilauea Street near Pier No. 1, it being the most important dock where Oriental cargoes are landed. In building this structure the very best plans for economy as well as efficiency were used. Every precaution has been used to make fumigation without danger to human life, and two ventilators, one to expel heavy gases and the other to expel light gases, have been installed. We have had occasion to use the house, and have had excellent results. Through the kindness of the Board of Harbor Commissioners, the old office under the staircase has been changed to a large roomy office at the entrance of Pier No.



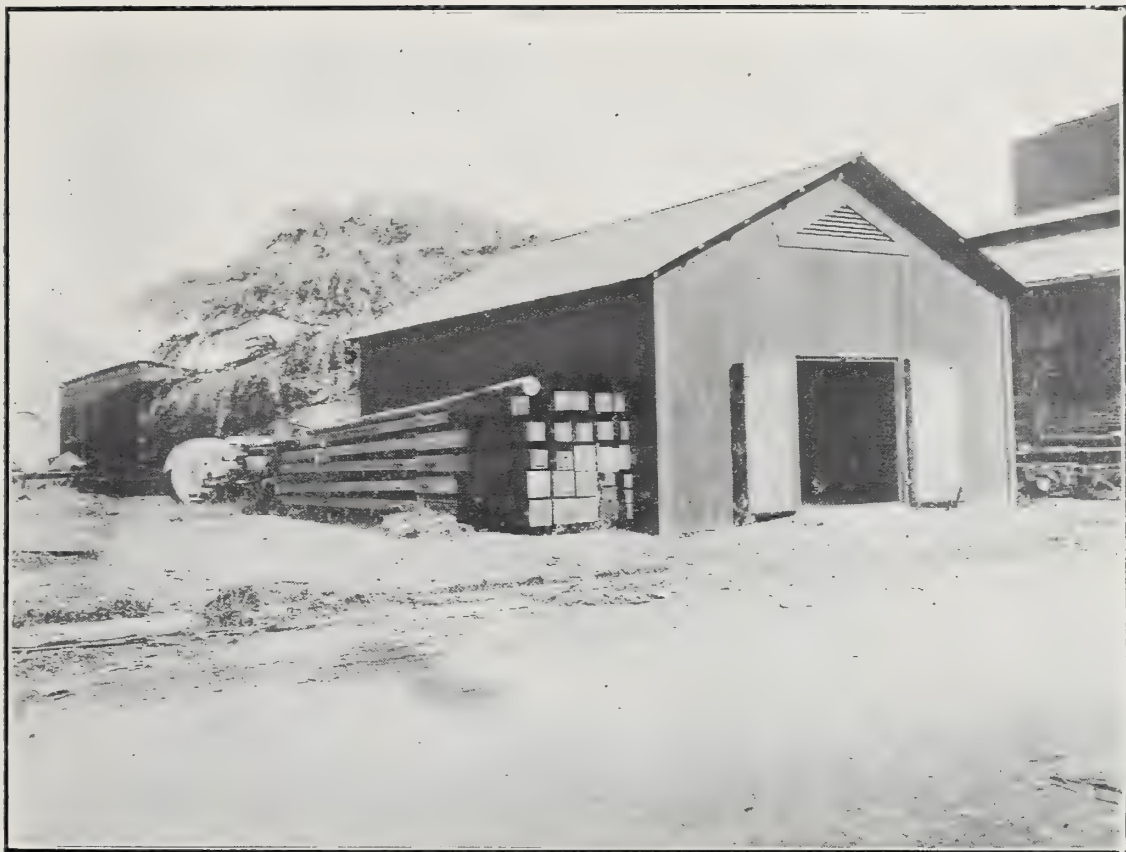


Plate 15. Fig. 1. Plant fumigating house, Kilauea Street, Honolulu.



Plate 15. Fig. 2. Timbers destroyed by Termites or White Ants in Honolulu.







7. The office is more commodious, has a cement floor, and has greatly assisted us in our important work. I take this opportunity in again thanking the Board of Harbor Commissioners for their cooperation and many past favors. As the Port of Hilo is now in direct communication with the Orient we are somewhat handicapped in regard to a suitable fumigating room. The small room on the Matson Wharf is sufficient for ordinary work, but would not answer in case a large shipment of rice had to be treated. This matter was taken up during the last year, but as the Kuhio wharf was without covering it was thought best to postpone the erection of suitable quarters at present. However, that we might be prepared to handle an infested shipment, should such arrive, I had two large gas-proof tarpaulins made, which can be used for the purpose until such time when a better equipment can be installed. The question is often asked why rice shipments are found infested after being fumigated at Kobe, Japan. In reply to this I will state that these shipments can become infested from non-fumigated rice on board the steamers, because the rice shipments going to the coast from Japan are not fumigated, and very often the cargo destined for Honolulu is placed alongside or on top of these shipments. The larvae of the rice moth and rice weevils can readily crawl from one lot to another. The consignees at Honolulu or Hilo therefore can hardly be held responsible for infestations, especially if they have complied with the regulations of the Board. All bills of lading of rice shipments have the government certificate of fumigation attached. I have taken up the matter of fumigation for coast shipments with the California Commissioners of Horticulture, but so far no action has been taken.

#### INTER ISLAND INSPECTION.

During the biennial period the inspection of inter island shipments of fruits, vegetables and plants has been continued despite the fact that the Mediterranean fruit fly, for which this work was originally started, has found its way to all the islands. Now that this pest has gained a foothold on all the islands, we are more than ever convinced that other pests, which might be accidentally introduced at Honolulu, the port of entry, should be closely watched. Besides fruit, vegetables and plants especial stress has been put on inspection of soil attached to the roots of plants which were removed from the ground or recently potted. The constant finding of grubs and beetles and other noxious insects in soil from the Orient and other countries, demonstrates clearly the necessity of a very close inspection here. It is also well known that many fungi and diseases of plants are carried in soil and having a system for inter-island inspection, it will be a



very easy matter to so formulate regulations to prohibit absolutely the shipment of materials which would tend to carry any pest or disease, should such be accidentally introduced.

During the biennial period 1438 steamers going from Honolulu to various ports on the other islands were attended to, and 23,906 packages were examined. These consisted of 5,136 packages of plants, 18,116 packages of vegetables and 654 packages of fruit. The bulk of the plants were nursery stock shipped by the Division of Forestry in the usual plant boxes, being young seedlings grown in sterilized soil. The bulk of the vegetables was taro for poi making, and this is always thoroughly cleansed from soil before shipment. The fruit was mostly imported fruit from the mainland. In all 668 packages were refused shipment because of infestation, or, in the case of plants, because questionable soil was attached to the roots. On account of the rush of passengers at the gangways at time of sailing it has been our practice to inspect the staterooms, and especially look through the steerage quarters before the gangway is lowered. As far as finances and equipment would permit, everything has been done to make the inter-island inspection thorough.

The following tables give a summary of the inspection work performed at Honolulu and Hilo, also one table showing a summary of inter-island inspection:



MONTHLY INSPECTION AT HONOLULU, 1913

Month	Vessels Inspected	Vessels carrying Fruits and Vegetables	PASSED		FUMIGATED		BURNED		RETURNED		Fruits and Vegetables		TOTAL INSPECTED	
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels	Seeds	Plants	Lots	Parcels
Jan.....	43	27	863	23,959	13	219	67	104	..	..	99	370	942	24,282
Feb.....	32	21	563	20,853	5	9	35	46	..	..	117	60	603	20,908
Mar.....	39	25	878	22,221	15	329	69	87	..	..	197	469	962	22,637
April.....	38	25	693	15,492	6	43	33	52	2	11	146	131	734	15,598
May.....	40	24	677	13,322	9	424	48	65	1	1	113	450	735	13,712
June.....	40	21	1,129	16,929	11	32	65	74	1	1	556	107	1,206	17,036
July.....	43	22	1,035	18,392	17	575	43	135	2	61	56	523	1,087	19,163
Aug.....	43	23	910	21,827	4	13	34	43	..	..	45	52	948	21,883
Sept.....	34	22	1,200	26,948	1	1	39	45	5	82	133	81	1,245	27,076
Oct.....	43	25	884	24,782	3	255	49	108	2	26	152	408	938	25,171
Nov.....	37	25	892	24,739	11	36	63	75	..	..	124	250	966	24,850
Dec.....	34	22	1,201	26,805	15	1,914	68	77	1	1	128	2,482	1,285	28,797
Total	466	282	10,925	256,169	110	3,850	613	911	14	183	1,866	5,383	11,652	261,113



## MONTHLY INSPECTION AT HONOLULU, 1914.

Month	Vessels Inspected	Vessels carrying Fruits and Vegetables	PASSED		FUMIGATED		BURNED		RETURNED		Fruits and Vegetables	TOTAL INSPECTED		Rice	Beans
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels		Lots	Parcels		
Jan.....	39	27	963	22,998	14	1,144	102	128	2	2	22,888	1,081	24,272	33,940	4,089
Feb.....	34	24	683	15,276	1	27	41	43	42	196	15,025	729	15,388	18,005	1,721
March.....	39	29	1,227	22,911	2	3	86	91	166	142	23,724	1,322	24,171	17,872	2,366
April.....	36	26	648	17,712	33	7,771	62	91	21	3,877	17,553	751	25,595	32,576	2,357
May.....	37	25	840	14,188	4	64	22	23	1	126	13,964	867	14,276	10,567	1,098
June.....	35	24	1,309	20,071	1	1	47	48	1	79	19,956	1,358	20,121	34,981	3,521
July.....	37	20	1,016	20,590	13	36	33	33	4	66	20,460	1,066	20,663	22,569	2,434
Aug.....	37	18	1,099	23,100	2	101	30	52	1	59	23,033	1,132	23,254	31,397	2,179
Sept.....	32	18	1,444	37,157	1	6	12	27	1	142	36,856	1,458	37,191	18,044	1,786
Oct.....	36	18	1,145	30,441	1	2	27	27	1	41	30,274	1,174	30,471	40,674	2,112
Nov.....	39	22	1,208	30,740	9	123	39	39	4	1,468	29,269	1,260	30,906	41,778	6,883
Dec.....	42	21	1,311	29,851	9	1,393	49	114	138	1,590	29,578	1,375	31,496	8,287	3,152
Total	443	272	12,893	286,035	90	10,671	550	716	40	9,030	282,570	13,573	297,804	310,690	33,698



## MONTHLY INSPECTION AT HILO, 1913.

Month	Vessels Inspected	Vessels carrying Vegetable Matter	Passed	Burned	Returned	Lots	Total Inspected	Remarks
Jan.....	6	5	3,249	..	..	157	3,249	500 T. Sand
Feb.....	10	6	2,037	..	..	97	2,037	
March.....	6	4	2,783	..	..	127	2,783	6 T. Sand.
April.....	6	5	1,168	..	..	67	1,168	
May.....	10	5	2,381	..	..	115	2,381	One vessel had
June.....	9	5	1,866	..	..	107	1,866	ballast thrown
July.....	8	6	2,082	..	..	119	2,082	into sea.
Aug.....	8	6	3,353	10	..	214	3,363	
Sept.....	10	5	3,388	..	..	207	3,388	
Oct.....	8	4	4,010	..	..	237	4,010	
Nov.....	11	5	3,984	..	188	251	4,172	6457 bags rice.
Dec.....	7	4	4,315	1	..	226	4,316	110 bags beans.
Total	99	60	34,616	11	188	1,924	34,815	6,457 pkgs. rice.

## MONTHLY INSPECTION AT HILO, 1914.

Month	Vessels Inspected	Vessels carrying Vegetable Matter	Passed	Burned	Returned	Lots	Total Inspected	Notice	Rice Packages	Beans
Jan.....	7	5	2,191	100	3	122	2,294	..	630	588
Feb.....	7	7	1,923	39	..	91	1,962	..	..	..
March.....	9	6	1,924	..	..	107	1,924	..	6,100	420
April.....	11	6	2,408	..	..	132	2,408	..	..	..
May.....	10	6	2,259	..	..	147	2,259	..	6,500	311
June.....	9	6	2,797	..	..	142	2,797	..	..	..
July.....	8	5	2,443	..	..	215	2,443	..	5,833	195
Aug.....	10	5	3,252	..	..	271	3,252	..	..	..
Sept.....	11	6	3,479	..	..	208	3,479	40	7,395	193
Oct.....	7	5	5,427	..	20	203	5,447	..	..	..
Nov.....	7	5	3,191	..	..	215	3,191	50	1,950	188
Dec.....	9	5	3,537	..	..	192	2,537	..	..	..
Total	105	67	34,831	139	23	2,145	34,993	90	28,408	1,925



## FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1913.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples .....	3,519	3,606	5,527	2,425	1,884	812	856	3,397	6,681	8,000	6,239	6,685	49,631
Apricots .....	..	..	..	..	31	1,011	209	15	1	14	..	..	1,281
Artichokes .....	13	26	21	27	34	23	16	9	9	5	12	16	211
Beans .....	40	97	136	139	198	58	13	150	210	178	130	187	1,536
Cabbage .....	438	265	201	69	25	100	136	247	299	157	103	188	2,228
Cabbage (Pake) .....	13	23	..	..	..	..	..	..	..	..	27	35	98
Beets .....	26	3	22	2	5	..	10	..	15	38	21	26	168
Carrots .....	104	..	25	25	10	30	22	10	50	53	45	45	419
Cauliflower .....	193	254	223	168	220	244	213	170	246	145	196	224	2,496
Celery .....	103	78	123	89	68	66	140	146	273	176	254	207	1,723
Celery Root .....	..	..	..	..	..	..	..	..	1	..	5	3	9
Cherries .....	..	..	..	..	582	1,617	668	..	..	..	..	..	2,867
Cranberries .....	2	..	..	..	..	..	..	..	3	6	54	40	105
Rhubarb .....	4	7	36	45	58	47	23	4	1	8	6	11	250
Fruit .....	28	20	16	11	16	7	13	28	95	38	32	31	335
Garlic .....	71	76	73	63	24	57	73	103	73	68	45	52	778
Grape Fruit .....	83	69	142	121	116	116	73	18	32	68	81	145	1,064
Grapes .....	39	..	..	..	..	..	90	706	2,868	2,136	1,135	1,180	8,154
Horse Radish .....	8	11	6	9	10	4	5	4	8	7	8	7	87
Lemons .....	256	473	435	157	169	548	461	183	535	443	293	265	4,218
Limes .....	..	..	..	11	..	..	..	..	..	..	..	..	11
Megs .....	..	..	..	..	..	42	283	224	254	173	23	31	1,030
Melons .....	..	..	..	..	..	..	90	17	88	64	16	..	275
Nectarines .....	..	..	..	..	..	..	38	328	34	..	..	..	400
Nuts .....	61	110	73	59	32	46	190	79	165	75	291	348	1,529



Onions .....	2,061	1,354	1,724	283	113	1,801	1,953	2,161	2,113	1,998	1,179	2,430	19,170
Oranges .....	5,126	5,375	2,132	1,322	2,018	890	812	829	819	357	976	2,991	23,647
Parsnips .....	19	32	31	28	4	36	18	12	20	4	14	17	235
Peas .....	..	..	..	23	31	24	22	3	5	12	..	12	132
Peaches .....	..	..	..	..	..	714	1,277	1,571	2,052	734	40	..	6,388
Asparagus .....	..	1	53	96	78	55	24	..	..	1	2	1	311
Pears .....	28	18	..	..	..	..	449	653	1,221	890	280	241	3,780
Persimmons .....	20	..	..	..	..	..	..	..	10	252	492	325	1,099
Plants .....	111	38	80	64	69	66	37	23	69	27	52	278	914
Pomegranates .....	..	..	..	..	..	..	..	..	..	..	10	15	25
Plums .....	..	..	..	..	..	454	1,770	1,431	793	100	..	..	4,548
Prunes .....	10	..	..	..	..	..	50	20	64	..	..	..	144
Quinces .....	..	..	..	..	..	..	..	..	1	2	5	..	8
Seeds .....	68	99	147	97	85	53	31	38	104	84	66	106	978
Sprouts .....	22	26	9	4	..	..	..	..	9	11	12	23	116
Spuds .....	8,946	7,229	9,693	8,735	6,052	7,197	7,956	8,742	7,522	8,193	11,540	9,521	101,325
Squash .....	2	2	5	5	..	2	..	15	4	4	18	17	74
Sweet Potatoes .....	..	1	1	4	3	..	..	..	..	..	2	..	11
Tangerines .....	292	149	10	..	..	..	..	..	..	..	64	625	1,140
Tomatoes .....	..	7	..	..	1	1	..	2	..	..	..	..	11
Turnips .....	93	80	167	59	25	54	43	27	78	19	31	56	732
Trees .....	..	4	4	..	..	..	..	..	..	6	..	68	82
Vegetables .....	59	5	4	8	18	3	6	5	4	4	7	19	142
Bulbs .....	12	9	19	9	8	9	1	1	..	4	28	22	122
Total .....	21,870	19,547	21,138	14,157	11,986	16,187	18,071	21,371	26,829	24,554	23,834	26,493	246,037



## FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1914.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples .....	4,172	2,037	2,009	869	983	1,038	2,597	4,091	12,509	10,618	10,916	5,919	57,758
Apricots .....	..	..	..	..	40	633	140	22	5	..	..	..	840
Artichokes .....	5	8	29	36	27	28	15	3	3	6	24	36	220
Beans .....	400	635	386	251	120	175	43	245	263	264	15	419	3,216
Cabbage .....	129	40	29	5	..	33	35	91	381	360	379	169	1,651
Cabbage (Pake) .....	45	..	..	..	..	..	..	..	71	48	21	32	217
Beets .....	6	..	31	..	..	..	..	..	57	22	30	4	150
Carrots .....	27	6	32	..	..	..	..	..	80	22	48	51	266
Cauliflower .....	183	222	439	117	259	252	223	263	412	309	511	575	3,765
Celery .....	64	72	221	38	..	11	100	194	341	310	419	329	2,099
Celery Root .....	3	3	1	..	..	..	1	4	..	6	..	2	20
Cherries .....	..	..	..	..	1,092	1,426	47	..	6	..	..	..	2,571
Cranberries .....	3	..	..	..	..	..	..	..	3	13	30	32	81
Rhubarb .....	2	2	33	42	70	69	24	17	15	1	13	16	304
Fruit .....	25	46	26	20	21	40	21	44	47	36	23	44	393
Garlic .....	50	59	55	23	30	75	73	78	22	37	45	83	630
Grape Fruit .....	51	90	249	96	90	229	171	70	151	154	193	259	1,803
Grapes .....	16	..	..	..	..	..	207	1,462	3,168	2,121	1,943	470	9,387
Horse Radish .....	3	5	17	8	11	14	6	7	4	2	21	10	108
Lemons .....	212	133	631	260	377	573	316	442	376	261	259	382	4,222
Limes .....	..	..	..	..	..	..	4	..	..	..	..	3	7
Megs .....	..	..	..	..	..	302	290	289	502	252	181	62	1,878
Melons .....	..	..	..	..	..	..	..	..	4	..	..	..	4
Nectarines .....	..	..	..	..	..	..	64	261	..	..	..	..	325
Nuts .....	81	40	116	46	43	104	24	53	50	115	90	272	1,034



Onions .....	1,371	136	207	32	234	721	1,411	2,218	2,401	2,754	1,673	1,596	14,754
Oranges .....	4,703	2,619	3,093	3,647	3,725	3,637	2,843	1,638	2,486	2,197	2,478	4,984	38,050
Parsnips .....	11	23	27	1	6	38	15	20	36	5	21	31	234
Peas .....	16	5	18	27	53	36	28	8	..	..	..	5	196
Peaches .....	5	..	..	..	20	1,154	1,388	1,091	1,707	231	..	..	5,596
Asparagus .....	..	..	61	70	80	57	11	..	..	..	..	..	279
Pears .....	13	7	..	..	..	23	505	716	1,107	1,089	691	283	4,434
Persimmons .....	16	..	..	..	..	..	..	..	33	377	845	238	1,509
Plants .....	53	73	107	75	75	56	28	16	39	38	62	132	754
Sugar Cane .....	..	..	..	1	..	..	..	..	..	..	..	..	1
Plums .....	..	..	..	..	..	905	1,531	1,324	714	33	..	..	4,507
Prunes .....	..	..	..	..	..	..	..	..	29	..	..	..	29
Quinces .....	..	..	..	..	..	..	..	5	3	4	..	..	16
Seeds .....	88	113	231	82	117	63	80	36	102	83	100	133	1,228
Sprouts .....	6	6	3	..	..	..	..	..	8	5	15	36	79
Spuds .....	7,491	6,916	13,265	9,624	5,525	7,322	7,006	7,716	9,529	8,286	7,159	10,703	100,542
Squash .....	2	4	2	..	1	3	1	11	20	2	18	17	81
Sweet Potatoes .....	4	4	2	..	2	2	..	..	..	1	..	..	15
Tangerines .....	1,451	541	858	392	39	..	..	..	..	..	121	1,720	5,122
Tomatoes .....	..	1	..	1	..	..	..	..	1	1	2	6	12
Turnips .....	31	35	74	14	33	45	48	39	92	14	36	87	548
Trees .....	11	2	1	1	1	..	..	..	..	2	..	81	99
Vegetables .....	11	7	12	9	9	..	..	11	..	5	7	15	98
Bulbs .....	16	9	19	15	13	10	4	..	..	8	15	19	128
Total .....	20,776	13,899	22,284	15,802	13,096	19,078	19,300	22,485	36,785	30,092	28,404	29,259	271,260



## FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1913—FOREIGN

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples .....	3	7	17	10	8	7	2	7	2	11	13	17	104
Water Chestnuts .....	90	22	49	33	74	55	61	42	..	6	9	5	446
Beans .....	446	61	1	231	209	61	228	74	95	..	144	..	1,541
Bananas .....	1	..	..	..	..	..	..	..	..	..	..	..	1
G. Chestnuts .....	36	4	8	2	..	..	..	1	..	10	82	9	152
Caladiums .....	171	32	105	10	..	..	..	..	..	..	..	26	344
Cocoanuts .....	..	..	..	..	..	6	..	250	..	..	24	..	280
Lily Roots .....	..	..	..	..	..	..	..	7	1	4	3	..	15
Fruit .....	..	2	1	..	..	..	..	1	1	..	1	1	7
Garlic .....	2	..	6	7	41	32	8	2	1	1	1	2	103
Grape Fruit .....	9	2	11	9	15	16	3	4	..	3	3	6	81
Herbs .....	..	..	..	..	..	..	..	3	..	..	..	..	3
Horse Radish .....	4	..	7	2	1	..	..	3	..	3	3	16	39
Lemons .....	3	2	1	1	..	8	..	..	..	1	2	2	20
Yams .....	64	8	33	22	65	39	57	..	42	52	145	19	571
Ginger .....	35	16	33	11	50	36	39	16	33	41	51	6	367
White Nuts .....	16	6	1	..	1	..	..	..	..	9	13	4	50
Water Caltropes .....	..	..	..	..	..	..	..	1	2	..	..	..	3
Nuts .....	..	10	1	..	..	..	..	..	1	..	..	..	12
Onions .....	959	1,066	631	792	538	..	5	1	2	6	1	6	4,007



Oranges .....	12	8	16	9	5	9	..	2	..	2	..	2	9	7	79
Olives .....	5	..	8	..	..	..	..	..	..	..	..	2	2	3	18
Peaches .....	..	..	..	..	..	..	7	..	..	..	..	..	..	..	7
Peanuts .....	200	53	106	171	291	..	136	..	..	..	..	229	..	..	1,186
Sand .....	6	8	11	6	10	4	3	5	17	12	16	16	11	..	109
Persimmons .....	..	..	..	..	..	..	..	..	1	1	3	3	2	..	7
Plants .....	212	10	342	57	270	30	459	31	6	337	19	19	2,110	..	3,883
Pomelo .....	2	1	1	..	..	1	..	..	..	..	1	..	1	..	7
Pomegranate .....	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Pumpkins .....	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Seeds .....	31	18	50	49	28	523	25	17	29	68	58	..	22	..	918
Bamboo Shoots .....	4	..	..	3	2	..	..	..	..	..	..	..	..	..	9
Spuds .....	1	..	3	1	4	5	..	..	..	3	..	..	1	..	18
Squash .....	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Sweet Potatoes .....	35	10	19	6	17	14	12	14	5	4	14	14	4	..	154
Tangerines .....	29	10	8	1	1	..	..	1	..	..	13	13	19	..	82
Taro .....	..	..	3	3	2	..	..	2	3	..	2	2	..	..	15
Vegetables .....	..	2	3	2	..	1	1	3	..	3	4	4	1	..	20
Bulbs .....	35	3	24	1	103	2	26	..	6	40	151	151	4	..	395
Total .....	2,412	1,361	1,499	1,441	1,726	849	1,072	512	247	617	1,016	2,304	15,066		



## FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1914--FOREIGN.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples .....	13	8	11	15	6	6	4	3	2	8	11	5	92
Water Chestnuts .....	86	43	33	62	17	94	26	51	15	35	74	..	536
Asparagus .....	..	..	1	..	..	1	..	1	..	..	..	..	3
Beans .....	..	110	..	10	131	2	893	108	..	..	..	427	1,681
Bananas .....	..	..	..	..	..	..	..	..	..	..	..	..	..
G. Chestnuts .....	93	12	7	14	..	6	..	..	..	..	13	47	192
Caladiums .....	448	155	126	2	..	..	..	..	..	..	..	..	731
Cocoanuts .....	46	..	2	4,007	62	..	..	..	..	1	..	..	4,118
Lily Roots .....	11	..	..	..	..	..	..	..	..	..	..	1	12
Fruit .....	2	3	..	2	3	..	3	..	..	..	..	..	13
Garlic .....	9	..	58	91	16	78	14	48	..	13	22	2	351
Grape Fruit .....	3	3	12	9	5	9	4	9	..	1	..	4	59
Horse Radish .....	9	..	3	2	..	3	..	..	..	..	..	4	21
Lemons .....	..	1	..	1	..	1	..	..	..	..	..	..	3
Yams .....	64	8	41	78	25	108	25	71	8	72	106	33	639
Ginger .....	29	2	37	43	15	90	25	36	15	37	45	20	394
White Nuts .....	14	4	5	2	..	..	..	..	..	..	53	11	89
Nuts .....	..	3	..	2	1	1	..	..	..	..	..	5	12
Onions .....	1,081	802	954	1,426	550	300	..	1	..	..	..	1	5,115
Oranges .....	32	14	27	15	2	5	6	3	4	9	5	12	134





## FRUITS AND VEGETABLES RECEIVED IN HILO DURING 1913.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples .....	1,045	525	811	150	154	134	125	577	1,074	1,441	1,665	1,478	9,179
Apricots .....	..	..	..	..	..	50	55	..	..	..	..	..	105
Artichokes .....	1	1	9	3	4	2	..	..	1	9	5	4	39
Beans .....	..	..	1	18	296	210	135	190	215	..	..	..	1,065
Cabbage .....	..	..	..	..	..	..	..	..	..	..	..	..	..
Beets .....	..	..	1	..	1	..	..	..	..	..	..	..	2
Carrots .....	..	..	1	..	1	..	..	..	..	..	..	..	2
Cauliflower .....	12	13	19	10	17	17	8	11	9	20	16	22	174
Celery .....	2	4	6	2	3	1	..	6	6	25	25	18	98
Cherries .....	..	..	..	..	8	171	40	..	..	..	..	..	219
Cranberries .....	..	..	..	..	..	..	..	..	..	..	5	12	17
Asparagus .....	..	..	8	2	..	..	..	..	..	..	..	..	10
Fruit .....	..	..	..	..	..	..	..	..	..	..	..	5	5
Garlic .....	10	8	10	5	13	13	15	21	28	20	10	11	164
Grape Fruit .....	6	15	11	11	18	14	10	12	13	22	10	19	161
Grapes .....	3	..	..	..	..	..	..	216	97	264	175	81	836
Horse Radish .....	..	..	1	..	..	..	..	..	..	..	..	..	1
Lemons .....	18	21	78	21	16	16	27	33	35	18	25	61	369
Rhubarb .....	1	2	..	5	3	3	5	4	..	1	..	..	24
Melons .....	..	..	..	..	..	..	17	54	35	54	..	2	162
Nectarines .....	..	..	..	..	..	..	..	24	22	..	..	..	46

Nuts .....	15	..	..	5	7	9	..	..	5	10	85	17	158
Onions .....	264	134	91	35	147	119	199	..	380	339	232	180	2,544
Oranges .....	415	310	515	245	301	158	150	..	215	53	335	857	3,719
Parsnips .....	..	..	..	..	1	..	..	..	..	..	..	..	1
Peas .....	..	..	1	..	1	..	..	..	..	..	..	..	2
Peaches .....	..	..	..	..	..	7	95	..	136	227	..	..	564
Peppers .....	..	..	1	..	..	..	..	..	..	..	..	..	1
Pears .....	6	..	..	..	..	..	60	..	80	33	20	10	247
Persimmons .....	..	..	..	..	..	..	..	..	..	88	152	10	250
Plants .....	5	8	9	8	6	7	..	..	1	..	5	5	54
Plums .....	..	..	..	..	..	..	105	..	180	63	20	..	429
Pomegranates .....	..	..	..	..	..	..	..	..	..	117	269	..	401
Seeds .....	7	10	14	13	8	8	..	..	3	..	10	8	91
Sprouts .....	1	..	..	..	..	..	..	..	..	..	..	..	1
Spuds .....	1,288	936	1,195	635	1,375	926	1,028	..	1,214	1,206	1,071	1,352	13,270
Tangerines .....	150	50	..	..	..	..	..	..	..	..	35	159	394
Tomatoes .....	..	..	1	..	..	..	..	..	1	..	..	..	2
Turnips .....	..	..	..	..	..	..	..	..	..	..	2	4	6
Vegetables .....	..	..	..	..	1	..	..	..	..	..	..	1	3
Total .....	3,249	2,037	2,783	1,168	2,381	1,866	2,082	3,363	3,388	4,010	4,172	4,316	34,814





Onions	269	111	103	85	112	307	361	308	252	558	254	232	2,952
Oranges	425	308	298	490	675	350	287	566	510	751	445	475	5,580
Parsnips	1	..	..	..	..	..	..	..	..	..	..	..	1
Peas	..	..	..	..	..	1	..	..	..	..	2	..	3
Peaches	..	..	..	..	10	54	59	36	72	49	..	..	280
Asparagus	..	..	..	5	7	3	..	..	..	..	..	..	15
Pears	9	5	5	..	..	..	..	78	40	69	20	2	228
Persimmons	..	..	..	..	..	..	..	..	..	78	51	45	174
Plants	..	13	13	9	9	..	2	..	..	..	..	..	46
Plums	..	..	..	..	..	27	97	101	46	..	..	..	271
Pruines-Pomegrts.	..	..	..	..	..	..	..	..	20	40	5	..	65
Seeds	5	26	26	13	7	4	2	5	5	12	25	15	145
Spuds	1,030	1,010	1,000	1,428	717	1,454	1,281	1,164	1,575	1,736	846	1,122	14,363
Squash	..	..	..	..	..	3	..	..	..	..	..	..	3
Tangerines	108	23	23	15	23	12	..	..	..	..	65	176	445
Tomatoes	..	..	..	..	..	..	..	..	..	1	1	..	2
Turnips	8	3	3	..	4	1	..	..	2	2	3	1	27
Vegetables	11	..	..	3	2	3	2	1	..	..	3	..	25
Total	2,294	1,962	1,924	2,408	2,259	2,797	2,443	3,252	3,479	5,447	3,191	3,537	34,993



## INTER-ISLAND REPORT, 1913-1914.

Month.	Steamers Inspected.	PASSED.				REJECTED.				Total Inspected.
		Plants.	Fruit.	Vegs.	Total.	Plants.	Fruit.	Vegs.	Total.	
1913										
January	62	66	1	832	899	12	15	6	33	932
February	54	43	..	701	744	10	16	..	26	770
March	58	91	..	811	902	8	14	..	22	924
April	62	80	8	766	854	14	21	1	36	890
May	68	475	16	750	1,241	21	16	4	41	1,282
June	56	64	23	664	751	6	20	..	26	777
July	69	807	7	693	1,507	11	10	..	21	1,528
August	57	856	12	700	1,568	28	9	..	37	1,605
September	63	387	16	603	1,006	12	11	..	33	1,029
October	58	34	45	643	772	11	8	2	21	743
November	51	625	20	968	1,613	10	6	1	17	1,630
December	58	392	26	1,107	1,525	12	10	1	23	1,548
1914										
January	56	76	12	1,126	1,214	9	13	..	22	1,236
February	52	78	18	1,002	1,098	16	8	2	26	1,124
March	67	75	25	542	642	14	3	1	18	660
April	54	59	18	437	514	16	11	..	27	541
May	58	53	42	512	607	17	3	..	20	627
June	62	96	28	676	800	7	6	2	15	815
July	60	75	12	739	826	16	12	1	29	855
August	61	86	14	792	892	14	26	..	40	932
September	63	62	..	1,035	1,097	8	28	..	36	1,133
October	62	83	..	710	793	26	17	..	43	836
November	60	77	..	517	594	21	17	..	38	632
December	67	68	3	768	839	9	8	1	18	857
Total	1,438	4,808	346	18,094	23,298	328	308	22	668	23,906

The preceding tables give an exact account of the amount of lots and packages of fruit, vegetables, seeds and plants arriving at Honolulu, and Hilo during each month of 1913 and 1914; also the disposal of the various shipments. A separate table for each year also shows the foreign shipments and their disposal. No fruits or vegetables are allowed entry from any of the Oriental ports nor from Australasia nor any of the Pacific Islands. All shipments from Mexico and Central America direct or via Pacific Coast ports are also prohibited. With our present facilities very few plants are now hauled from one dock to another for treatment, these being from Pacific Coast ports only, and most of these are brought by the Matson Navigation Company's boats. We have not as yet transferred our fumigating room from the old Matson Wharf or Hackfeld Wharf, Pier No. 16, as there is no suitable place for it on the new Matson Wharf, Pier No. 15, and as there are possibilities of rearranging some of the wharves in the near future, I thought best not to change the situation at the present time.

#### PESTS INTERCEPTED.

In our inspection work we naturally find a great variety of pests. Some very injurious insects of other countries have been discovered in our search during the biennial period. Probably the most remarkable seizure ever made by the division took place in the Post Office—a package of tree twigs from Japan was held for our inspection, and on opening the same hollow tree twigs were found with the opening at each end plugged up with twisted grass. A closer examination disclosed the fact that each twig contained a good, fat live borer. We were at a loss to know the object of this sending, but from a Japanese letter enclosed in the package we got the following story:

“Greetings; this time I am sending you some medicine good for consumption. Open the twigs and you will find a worm (*Sabutori-mushi*) in each twig. Take out one and wrap it in sembi or ame and swallow it alive. The juice of the living worm is good for the disease. However, if the worms are dead, you can bake them until black and powder them up and drink it with sake. Those I send will constitute a dose for one week. (There were 12 live grubs in the package.) When you take the worms please inform me if you digest the same. If you should find any such worms in Hawaii continue taking same for some time, etc., etc.”

The worms found in the twigs represented two distinct orders of insects. Some were the grubs of a large stem boring beetle belonging to the *Cerambycidae*; the others were the larvae of some stem boring moth. The package was destined to the Island of



Maui, and was seized and the twigs and larvae are the property of the Board museum as alcoholic specimens. This illustrates another channel through which some serious pest might enter the Territory. Worm diet for the cure of the White Plague might be all right in Japan, but we have not as yet heard of this method being used here, and we surely shall not allow a trial with imported borers such as were found in this mail package. Since the arrival of the first package we found another with the same species of borers, also a bamboo tube in the baggage of a Japanese immigrant, containing 18 grubs; these, however, had been baked beforehand. They also have added to our ever-growing exhibit. On several occasions we have found the grubs of the Japanese rosebeetle, the *Anomala* beetle and *Sericea Japonica* closely allied to it, also grubs of a small weevil attacking the fibrous roots of plants in the soil attached to nursery stock coming from Japan. These are all serious pests as we well know from past experiences. I am told by Mr. F. Muir that the small weevil is a very serious pest to potted plants in Japan. The Orchid borer (*Acytheopeus aterrimus*) is frequently found in *Dendrobiums* from the Philippines. The beetle would cause serious damage to Orchids here and might for the lack of food attack other plants if ever introduced. All Orchids are very carefully examined before they are permitted to enter the Territory. On two occasions we found the larvae and pupae of a large *Cicada*. Once among the roots of pot plants from Japan and again in the soil and packing of a shipment of Orchids from Manila, P.I. Cicadas Locusts or Harvest flies, as they are commonly called, are very injurious insects in many parts of the world. The seventeen year locust of the United States has done such serious damage that volumes have been written and thousands spent in the fight against it. There are no Cicadas known in the Territory.

Another incident of a possible way by which pests could be introduced was illustrated by the finding of two hairy caterpillars crawling on the coat-sleeve of an immigration inspector while on duty on board of an Oriental boat. A search was made for the source of these caterpillars, and a plant belonging to the steamer and located in the lobby near the stairs had been infested and the foliage had been seriously eaten. No other caterpillars were found. The man had probably brushed against the plant or had come in contact with it while standing near the same. It would have been a very serious matter for the caterpillars to have been carried off the steamer onto the dock, and they could have easily dropped off of the sleeve on the street near some hedge or garden.

A large number of insects in many orders, also slugs, snails, crustaceans, centipeds and millipeds have been taken in the soil and packing around plants from Australia,



Plate 16. Fig. 1. Mail shipment of twigs from Japan containing wood boring larvae.

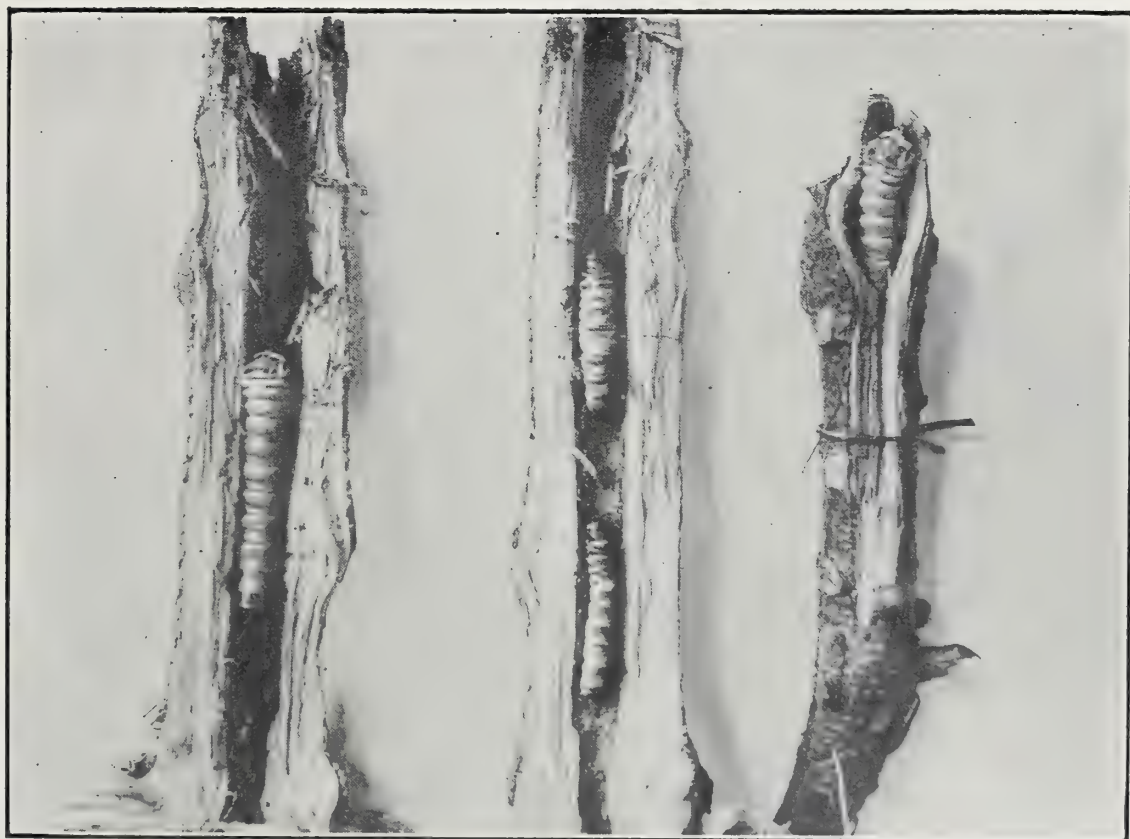


Plate 16. Fig. 2. Wood boring larvae sent from Japan for medicinal purposes and taken in quarantine at post office.





Asia and Islands of the Pacific. Too little is known of many of these, but it is safe to say that many of them would, no doubt, prove extremely troublesome to our beautiful gardens. The fruit shipments from the Pacific Coast as a whole arrive in a very clean condition, and the quality of these shipments has vastly improved during the last two years. It was found necessary to clean the boxes of several apple shipments from San Francisco in which the larvae of the codling moth had crawled and pupated, the fruit being in good, clean condition. I can only account for this as being a case of careless storage among inferior wormy fruit in some packing house on the Coast.

On one occasion a package of sugar cane, known as Japanese sugar cane, arrived by mail from Florida, and was consigned to a party on Maui. On examining the sugar cane I found it infested with a disease, *Colletotrichum falcatum*, kindly determined for me by Dr. H. L. Lyon, of the Hawaiian Sugar Planters' Association. The package was burned in Lucas' mill, and the party received a quantity of good clean Japanese cane from Mr. Agee, of the H.S.P.A., at my request.

#### PESTS INTERCEPTED IN COURSE OF INSPECTION.

Unfortunately the identification of many species taken has been left undone because of the great rush of work in other lines. However, all material on hand is in good condition, with accurate data, so that when time permits, the identification of the same can be undertaken.

#### Bugs (*Hemiptera-Homoptera*).

..

*Aradid* sp., on orchids, Manila.

*Cicada* sp., in soil and packing of plants, Japan, Manila.

*Reduviid* sp. in plant packing, Manila.

*Pentatomid* sp. in plant packing, Manila.

*Capsid* sp. taken four times in plant packing, Manila.

*Hemipterous nymph.*, in soil, Japan.

#### Scale Insects.

*Aspidiotus cyanophylli* on orchids, U.S.A.

*Aspidiotus hartii* on yams, Guam.

*Aspidiotus rapax* on mistletoe, laurel and apples, U.S.A.

*Chionaspis mussaendae* on hibiscus, Samoa.

*Chrysomphalus biformis* on orchids, Manila.

*Coccus hesperidum* on citrus, New York.

*Diaspis boisduvalii* on orchids, New Jersey.

*Fiorinia fioriniae* on orchids Java, Strelitzia, California.

*Hemichionaspis minor* on hibiscus, Samoa and cocoanuts, Fanning Island.



- Hemichionaspis aspidistrae* on orchids, Australia.  
*Lepidosaphes cocculi* on dendrobium, Manila.  
*Lepidosaphes beckii* on oranges, Florida.  
*Parlatoria pergandii* on orchids, Manila.  
*Pseudococcus citri* on citrus, U.S.A.  
*Pseudococcus azaleae* on azalea, Japan.  
*Pseudococcus longispinus* on palms, Australia.  
*Pseudococcus species* on ginger, Samoa.  
     "          "          on orchids, Costa Rica.  
     "          "          on palms, Samoa.  
*Pulvinaria camelicola* on camellia, Japan.  
*Saissetia olea* on oleander, U.S.A.  
*Saissetia olea* on palms, Australia.  
*Saissetia nigra* on hibiscus, Samoa.  
*Saissetia hemisphaerica* on ardisia, Japan.

#### Plant Lice (*Aphididae*).

- Macrosiphum rosae* on rose plants, California.  
*Macrosiphum sanborni* on chrysanthemums, California.  
*Mysus persicae* on carnations, California.

#### White Flies (*Aleyrodidae*).

- Aleyrodes spiracoides* on jasmine and geraniums, U.S.A.  
*Aleyrodes citri* on citrus, Japan.

#### Butterflies and Moths (*Lepidoptera*).

- Anarsia lineatella* on peaches, California.  
*Carpocapsa pomonella* in apples, California.  
*Paralipsa modesta* in rice and beans, Japan.  
*Sitotroga cerealella* in corn, U.S.A.  
*Omphisa anastomosalis* in sweet potatoes, China.  
*Isia isabella* on potato bags, Seattle, U.S.A.  
*Lycaenid larva* and pupa on dendrobium, Manila.  
*Leaf miner* citrus leaves, Japan and Australia.  
*Sesiid larvae* in bark of gardenia, Japan.  
*Larvae* in roots of plants, Japan.  
*Larva* in sunflower seed, Portugal.  
*Larvae* in hollow twigs, Japan.  
*Larvae* in cocoanut sprouts, Palmyra Isles.  
*Larvae* on camellia, Japan.  
*Caterpillars* on coat of inspector, Japan.  
*Caterpillars* on ornamental plants, Japan.

#### Beetles (*Coleoptera*).

- Carabid* in moss, California.  
*Carabid* on merchandise, California.  
*Bembidium* in plant packing, Manila.

- Carabid* in plant packing, California.  
*Carabid* (four species) in orchid shipment, Manila.  
*Dytiscid* in orchid shipment, Manila.  
*Hydrophilus* on iris roots, Japan.  
*Pselaphid* in orchid shipment, Manila.  
*Sylphid* on merchandise, California.  
*Staphylinid* (2 species) plant packing, California.  
     "      (3 species) in orchid shipment, Manila.  
*Silvanus surinamensis* in plant packing, Manila.  
*Dermestes vulpinus* in baggage, Japan.  
*Elaterid* in banana roots, Manila.  
*Elaterid larvae* in soil, Japan.  
*Elaterid* in plant packing, California.  
*Agrilus* in plant packing, California.  
*Necrobia rufipes* in copra, Fanning Isles.  
*Clerid* in orchid shipment, Manila.  
*Anomala orientalis* larvae and pupae in soil, Japan.  
*Anomala larvae* (2 species) in soil, Japan.  
*Serica japonica* grub in soil, Japan.  
*Adoretus* grubs in soil, Japan.  
*Lachnosterna* grub in soil, California.  
*Cerambycid* grub in plant stems, Japan.  
*Cerambycid* grubs in hollow twigs, Japan.  
*Chrysomelid* in plant packing, Australia.  
*Flea beetle* in dendrobium flower, Manila.  
*Epitrix* in plant packing, California.  
*Flea beetle* in azalea, Japan.  
*Chrysomelid* in plant packing, California.  
*Bruchus chinensis* in peas and beans, Japan.  
*Bruchus pisorum* in horse beans, Spain and Portugal.  
*Bruchus prosopis* in prosopis pods, Arizona.  
*Alphitobius piceous* in banana roots, Manila.  
     "      "      in plant packing, various countries.  
*Balaninus* grubs, in chestnuts, Japan and U.S.A.  
*Cryptorhynchus* species in Heritera seeds, Manila.  
*Sphenophorus sordidus* grubs in banana roots, Manila.  
*Cylas formicarius* in sweet potatoes, Orient.  
*Acytheopeus aterrimus* in orchid stems, Manila.  
*Curculionid* (2 species) in orchid stems, Manila.  
*Weevil* grubs and pupae in roots of plants, Japan.  
*Calandra granaria* in corn, U.S.A.  
*Calandra oryzae* in rice, Japan.  
*Calandra species* in seeds, Australia.  
*Araeocerus species* in Fiziplus seeds, Manila.



Ants, Bees and Wasps (*Hymenoptera*).

- Habrobracon habitator* on infested rice and packing, Japan, California.  
*Bethelid species* in plant packing, California.  
*Dolichoderus bituberculatus* in soil, Manila.  
*Euponera leutipes* in orchid shipment, Manila.  
*Formica species* in soil, Japan.  
*Lasius niger* in soil, Japan.  
*Monomorium pharaonis* in soil and packing, Manila.  
*Monomorium vastator* in soil, Japan.  
*Monomorium floricola* in orchid shipment, Manila.  
*Solenopsis geminata* in baggage, Spain.  
*Leptothorax species* in moss, England.  
*Prenolepis longicornis* in plant packing, Orient.  
*Prenolepis obscura* in soil packing, Japan and Manila.  
*Prenolepis bourbonica* in soil, Manila.  
*Prenolepis imparis* in soil, California.  
*Ponera species* soil and packing, Manila and Spain.  
*Solenopsis geminata* soil, England.  
*Technomyrmex albipes* orchid shipments, Manila.  
*Tetramorium guineense* soil, Manila, Australia.  
*Tapinoma sessile* plant packing, California.

Flies (*Diptera*).

- Drosophila species* on orchids, Manila.  
*Drosophila species* in fruit, California.  
*Phorid species* in soil, Japan.  
*Ptectus species* in soil, Japan.  
*Phorbia brassica* in turnips, California.  
*Tipulid species* in soil, Japan.

Grasshoppers, Crickets and Roaches (*Orthoptera*).

- Myrmecophilus species* in soil, Manila.  
*Ectobia germanica* in baggage, various countries.  
*Periplaneta americana* in baggage, various countries.  
*Periplaneta australasiae* in baggage, etc., various countries.  
*Blatta orientalis?* nymph. in plant packing, Manila.  
*Epilampra inconspicua?* in plant packing, Manila.  
*Oligotoma species* in dead orchid stems, Manila.

## Miscellaneous.

- Tetranychus species* on rose plants, California.  
*Bryobia species* on jassamine, Ohio.  
*Tyroglyphus species* on decaying plants, Manila.  
*Spider species* in plant packing, various countries.  
*Centipeds* in plant packing, various countries.

*Millipeds* in plant packing, various countries.

*Oniscus species* in plant packing, various countries.

*Land shells, Opeas, Kaliella species* in plant packing, various countries.

*Veronacella species* in plant packing, various countries.

*Gecko species* in plant packing, various countries.

#### Diseases (Fungi).

*Cladosporium citri* on citrus, Japan.

*Citrus canker* on orange, Japan.

*Colletotrichum falcatum* on sugar cane, Florida.

*Fusicladium dendriticum* on apples, California.

*Glaeosporium species* on apples, Japan.

*Oospora scabies* on potatoes, Pacific Coast.

*Phragmidium subcorticatum* on roses, U.S.A.

*Puccinia arenariae* on carnations, Pacific Coast.

*Sphaerotheca pannosa* on roses, Pacific Coast.

#### FEDERAL HORTICULTURAL BOARD.

In my biennial report of 1911-1912 I mentioned the fact of having been appointed collaborator of the Federal Horticultural Board, to supervise the inspection of the Federal plant quarantine act of August 20, 1912. During the years of 1913 and 1914 various rules and regulations known as quarantine notices have been passed and published prohibiting the introduction of certain plants, fruits and tubers from foreign countries, or prohibiting the transportation of these articles from infested areas on the mainland and from these islands to the mainland. Realizing the necessity of having assistance in case of illness or absence from the port of entry of the Territory, I requested that Mr. D. B. Kuhns and Mr. J. C. Bridwell be made collaborators, which request was granted, and since Mr. Bridwell's trip to Africa warranted his resignation as collaborator, I had Mr. Edward Drew appointed in his place. The additional powers we receive under Federal regulations have materially assisted us in regulating the unlisted small package usually brought in by tourists or friends of our citizens. Regulation 3 of the Plant Quarantine Act requires all importers of foreign plants to first make application to the Federal Horticultural Board for a permit, stating in the application the name and address of the exporter, the country where plants are grown, the port of entry and the name and address of the importer in the Territory to whom the permit should be sent. These applications for permits should be made in advance of shipment of nursery stock. During the biennial period our work has been materially strengthened by this regulation, and but very few shipments coming here have not had the required permits, and these were



held in quarantine pending the arrival of a permit from Washington. The regulations have greatly discouraged the promiscuous fetching in of plants by the travelling public; plants which are gathered at random and packed in every kind of soil, moss or other material and have always proved a menace in the past. It is usually this small package wherein lies the greatest danger, and one of the main objects of the Federal Horticultural Board is to discourage this traffic. With the cooperation of the Post Office Department the Federal Horticultural Board has been able to cause the prohibition of all plant and seed shipments from foreign countries in the mails, so that many of the small packages of plants and seeds in the post offices, which were liable to be overlooked in the past, are now completely cut out, excepting such as are addressed to the United States Department of Agriculture, Washington, D. C., or their representatives in the various states or territories. This regulation is entirely in the hands of the postmaster, and does not affect flower, vegetable or field seeds. To import plants into this Territory the following requirements are absolutely necessary:

(1) The importer or his broker must first make application for a permit to import plants before ordering the same.

(2) Each package imported must bear the proper certificate of foreign inspection from countries which maintain official inspectors.

(3) Each package or container must be marked and must bear a certificate giving a list of all plants contained therein, the name of the shipper or grower, the name of the consignee and the locality where grown.

(4) Each shipment must be accompanied with a consular invoice and declaration not attached to the container but with the bill of lading.

Under the provisions of section 7 of the plant quarantine act of August 20, 1912, the following extracts of the various notices of quarantine might be of interest:

*Quarantine No. 1.* Superseded by Quarantine No. 7, prevents the introduction into the United States of the White Pine blister rust (*Peridermium strobi*) and forbids the importation of all five-leaved pines from each and every country of Europe and Asia.

*Quarantine No. 2.* Was published Sept. 18, 1912, to protect the United States from entry of the Mediterranean fruit fly, now thoroughly established in the Hawaiian Islands, and it prohibits the shipment of any of the fruits and vegetables specified in the Notice of Quarantine into or through any other State, Territory or District of the United States.

*Quarantine No. 3.* Was published September 20, 1912, to

prevent the introduction into the United States of the disease known as *Potato wart*, *Potato canker* or *Black scab*, and forbids the importation into the United States from Newfoundland, Islands of St. Pierre and Miguelon, Great Britain and Ireland, Germany and Austria-Hungary, of the common Irish potato (*Solanum tuberosum*). This is a very important quarantine for these Islands, as most of our Irish potatoes are imported, and what few potatoes are grown here are free from any very serious disease.

*Quarantine No. 4*, revised and amended as No. 10 and published June 24, 1913, describes and quarantines the districts in New England infested by the Gypsy Moth and Brown Tail Moth, and makes regulations governing the movement in interstate commerce of plants and plant products which may be infested from the areas quarantined.

*Quarantine No. 5*, published January 15, 1913, prevents the introduction into the United States from Mexico of the insect known as the Mexican fruit fly (*Trypeta ludens*), and prohibits the importation from that country into the United States of oranges, sweet limes, mangoes, sapotes, peaches, guavas and plums. It was amended February 8, 1913, to include also grapefruit and its horticultural varieties.

*Quarantine No. 6* was published March 1, 1913, for the purpose of preventing further distribution in the United States of two serious date palm scale insects (*Phoenicococcus marlatti* and *Paralatoria blanchardi*). It quarantines certain counties in California, Arizona and Texas, where these pests exist, and makes regulations governing the interstate movement of date palms grown within the areas quarantined.

*Quarantine No. 8* was published on May 28, 1913, to prevent the introduction into the United States of the Pink Boll Worm (*Gelechia gossypiella*) of cotton, and forbids the importation into the United States of cotton seed of all species and varieties and cotton seed hulls from any foreign locality and country, excepting only the locality of the Imperial Valley in the State of Lower California, Mexico.

*Quarantine No. 9* was published June 24, 1913, and applies to the Territory of Hawaii and prevents the exportation of all cotton seed and cotton seed hulls from this Territory into or through any other State, Territory, or District of the United States, also on account of the Pink Cotton Boll worm, which exists in Hawaii.

*Quarantine No. 11* was published December 22, 1913, to prevent the introduction into the United States of serious diseases of the Irish potato, including the powdery scab (*Spongospora subterranea*), known to exist in Canada, Newfoundland, the Islands



of St. Pierre and Miguelon, Great Britain, Ireland and Continental Europe. Like the notice of quarantine No. 3, this ruling is also of very great importance to this Territory owing to the enormous shipments of potatoes coming here as imports.

*Quarantine No. 12* was published February 27, 1914, and regulates the importations of Avocado seed. The Avocado weevil (*Heilipus lauri*) is a very serious and injurious pest which exists in Mexico and Central America. In order to prevent the introduction of this pest, the importation into the United States of the seeds of the Avocado or Alligator Pear is entirely prohibited.

*Quarantine No. 13* was published on March 23, 1914, for the purpose of prohibiting the exportation of certain fruits and vegetables from the Hawaiian Islands on account of two dangerous insects, the Mediterranean fruit fly (*Ceratitidis capitata*) and the Melon fly (*Dacus cucurbitae*), into or through any State, Territory or District of the United States. A full list of fruits and vegetables is given. A full set of regulations is included. Bananas and Pineapples can be exported under supervision and inspection.

*Quarantine No. 14* was published April 25, 1914, to extend the quarantine against the powdery scab (*Spongospora subterranea*) to the State of Maine, where the disease is known to exist.

*Quarantine No. 15* was published on June 6, 1914, for the purpose of preventing the introduction into the United States of insects and fungous diseases of sugar cane existing in foreign countries. This quarantine does not affect Hawaii or Porto Rico.

*Quarantine No. 16*, published the same date, forbids exporting living canes of sugar cane or cuttings or parts thereof from the Territories of Hawaii or Porto Rico into or through any State, Territory or District of the United States, regardless of the use for which they may be intended.

*Quarantine No. 17* was published July 3, 1914, for the purpose of quarantining certain areas in the United States containing two injurious insects known as the Gypsy Moth (*Porthetria dispar*) and the Brown-Tail Moth (*Euproctis chrysorrhoea*) and preventing coniferous trees, described as "Christmas trees" and "Christmas greens or greenery" and forest plant products and other plant products for planting or propagating, from being moved inter-state from any point of the areas mentioned in the quarantine act. It also prescribes Gypsy Moth regulations and Brown-tail Moth regulations concerning the packing, marking, shipping, inspection, etc., etc.

*Quarantine No. 18* was published November 14, 1914, to extend the quarantine against the Powdery Scab (*Spongospora subterranea*) to the State of New York where the disease is known to exist, and prohibits the movements of Irish potatoes from the

State of New York into or through any other State, Territory or District of the United States.

*Quarantine No. 19* was published December 10, 1914, for the purpose of prohibiting the importation of all citrus nursery stock, including buds, scions, and seeds, from Europe, Asia, Africa, South America, North America outside of the United States, and foreign Oceanic countries and Islands on account of a very serious disease of the Citrus known as the Citrus Canker. The disease Citrus Canker has only recently been found in Florida, U. S. A., and from accounts has done considerable damage to citrus groves in "various" sections of that State. The disease must have been present there for some time but like so many similar diseases, was overlooked or taken for scab, scaly bark or Anthracnose. It has been found on *Citrus trifoliata* from Japan. I have condemned several shipments of young citrus trees coming into the Territory showing some scabby growth, and some fruit, which is prohibited and showed signs of a disease which no doubt was Citrus Canker. Under the enforcement of Quarantine No. 19 all danger of importing infested citrus plants in the future is passed.

#### INSECT PESTS AND REMEDIES.

During the past two years the following insects have proven quite a menace to plant life in and around Honolulu as well as in some districts on the other islands:

##### *Japanese Rose Beetle (Adoretus tennimaculatus).*

Probably this beetle has caused more annoyance to people than any other pest we have. Owing to severe dry spells during the early summer, especially in 1914, there was a very material increase of this pest in the drier sections. Not only was the damage reported by the flower lover, but the vegetable grower had great destruction wrought to his beans, egg plant and other tender growth, and at times it no doubt seemed intolerable. There is no question but that the adult and larva of this species is kept in check by the beetle fungus when climatic conditions are right, that is to say, when we have warm moist weather to induce the spread of the fungus. But, when such conditions do not exist for a period of six months, the beetle becomes very abundant and very destructive. Collecting beetles at night has been tried by some who cared a great deal for their plants, but while many people will do this collecting regularly and conscientiously the next door neighbor will not bother about the pest, and after his plants have fed a multitude of beetles and they are left leafless the beetles soon migrate to the neighbors' gardens and all the work has to be done over again, which at best is most discouraging.



*Cocoanut Palm Leaf Roller (Omiodes blackburni).*

The adult of this caterpillar is not much observed or known by the general public, nor are the inconspicuous egg masses often seen, but the caterpillar or leaf roller is the individual who does attract attention when the beautiful new palm leaves begin to look ragged with streaks of brown. Generally speaking, although the insect is constantly present, attacking the cocoanut and native palms, very little complaint has been made until this year. Young cocoanut plantings on Oahu as well as Kauai suffered very severely and much inquiry fell into our hands. The pest usually is kept in check by the several parasites attacking the eggs, larvae and pupae, and the serious attack this year can probably be accounted for by unfavorable weather conditions for the rapid increase of the parasites. In two localities, one on Oahu and one on Kauai, groves which are partly protected by good windbreaks show a decided difference where the palms are in the lee of the windbreak over the palms which get the full benefit of strong winds. It is natural to expect some such difference so far as the minute parasites are concerned, for they must have quite a struggle to spread from palm to palm, where strong winds have been existing for any length of time. Some of the growers are going to plant more windbreaks as they can readily see the difference in their own groves.

*Alligator Pear Bark Beetle (Xyleborus immatulus).*

Much complaint has reached this Division of the damage done to the limbs and trunks of the alligator pear tree. The damage generally has quite progressed before it is noticed. The pest, which is a very minute black oblong beetle, bores into the dying bark, deposits its eggs, and the larvae work under the bark and into the wood. When the insects are quite abundant they very often will attack even good healthy trees. The presence of the pest is generally noticed by a white powdery substance appearing on the limbs and trunk of the trees. If the trees show a few of the weaker or unhealthy limbs attacked, they should be removed as soon as possible and all affected spots should be cut out and a coating made of lime and crude oil applied. To prepare this crude oil whitewash, place twenty-five pounds of unslaked lime in a tub and put just enough water on to start it slaking, and when well started pour into it gradually one and a half gallons of crude oil. After the lime and oil have mixed well more water can be added if necessary; it should be well stirred and should have the consistency of thick cream. This when applied is a good repellent and also forms a very good coating for the affected parts.

*Tree Roach (Eleutheroda dytiscoides).*

Another pest which is causing much annoyance, especially to

those who have large cypress trees and hedges or *Thuya* plants is the Tree Roach. This is a flat, blackish brown roach living out of doors in the branches of cypress and similar trees and hedges. It does severe damage to the smaller twigs and branches by gnawing off the bark, causing the twigs to turn brown and die. Single trees can be protected in a way by dislodging the roaches, either shaking or beating the limbs with a stick and then killing the roaches that fall to the ground, but where quantities are growing or in the hedgerow this procedure is too laborious or expensive. Stearn's Roach Paste has been successfully used, but on account of frequent showers it must be placed in a small box. A medium sized candy box or a wooden box of equal size can be used. A hole the size of a fifty cent piece is cut out at each end, take a slice of bread, smear the roach paste thickly on it and place it in the box and tie on the cover. Hang the box in the shade of the tree among the branches where the roaches cluster. The box will act as a shelter for the pest and will furnish them the poisoned food. The dead roaches will be found in the box as well as on the ground and care should be taken not to let the chickens or domestic animals have access to the yard. This same remedy will be very successful for our common house roach by placing the bread in the cupboard or on the shelves of the pantry or kitchen.

#### *Cutworms.*

Several species of cutworms which are the larvae of our Noctuid moths have caused considerable damage to growing crops. The cutworm does not feed during the day, and for this reason so many people are at a loss to know what insect is doing the damage to their plants. A search in the soil near the base of the plant will soon reveal the culprit, which is a smooth caterpillar from one to one and a half inches long and when found is generally curled up. When these worms are abundant they are capable of doing enormous damage. Collecting the worms during the day time when the field is not too extensive has given good results. However, a better and cheaper method is the use of poisoned bait, which is scattered near the plants attacked. The following formula has given good results:

#### BAIT FOR CUTWORMS.

Parisgreen or white arsenic	.....	1	lb.
Molasses	.....	1½	Gal.
Bran	.....	20	lbs.

Mix parisgreen or arsenic dry with bran, add molasses and just enough water to moisten the mass. Place the mixture in rows in the infested fields. Frequent rains will make it necessary to repeat the operation. The mixture should be placed beside rather



than on the plant. Care must be taken to keep domestic animals out of the fields treated in this manner.

### *Mealy Bugs.*

We have three species of mealy bugs which do considerable damage to outdoor plants and trees. Probably the alligator pear mealy bug (*Pseudococcus nipae*) which also attacks the fig and many other plants and palms, is the most serious and has caused a lot of inquiry. This insect generally appears like magic and after doing the damage and disfiguring the tree is gradually diminished by the various ladybug beetles ever present in these Islands. However, it is the young trees which seem to suffer the most, and unless aided by the judicious use of a strong soap and water spray they will become stunted and worthless. Next in line is the fluffy mealy bug (*P. filamentosus*), which has the tendency to poison the tender shoots of hibiscus, citrus and other plants, causing them to distort and dwarf the flowers, as well as tender branches. The third species of importance is the pineapple mealy bug, which not only infests the pineapple, but does severe damage to the roots of many flowering plants and bulbs. Cannas, tuberose, coleus, amaryllis and many other plants suddenly become dwarfed and on taking them out of the ground the roots are one mass of whitish looking objects which are the pests here mentioned. All these species can easily be checked by using a soap wash made of one pound whale oil soap to three gallons of very hot water. After the soap is thoroughly dissolved the liquid should be applied quite warm, as most of these pests are greasy and the hot wash will take better hold on them.

### *Scale Insects.*

The two species which give the most trouble and loss are the Florida red scale (*Chrysoniphalus aonidum*) and the Purple Scale (*Lepidosaphes beckii*). These insects are especially fond of citrus trees but also do serious injury to palms and other garden and house plants. The whale oil soap wash as recommended for mealy bugs will do much towards reducing these pests.

### *Plant Lice or Aphids.*

Plant lice, like mealy bugs and scale insects, do very serious damage to tender growth. There are several species of Aphids in the islands which contribute to the damage and loss of crops, and which caused inquiry during the biennial period.

The *Cotton Aphis* (*Aphis gossypii*), which not only attacks cotton but many other plants is especially destructive to water-melon plants, and during 1913 and 1914 considerable complaint from various sections reached the office. It is a very hard problem



Plate 17. Natural enemies of Citrus mealy bugs and Aphids.

Infested twigs showing eggs, larvae and pupae of *Coelophora inequalis* and larvae of *Cryptolaemus montrouzieri* and *Xanthograunna graudicornis* feeding on mealy bugs and Aphis.

Upper left hand corner Syrphid fly (*Xanthograunna graudicornis*) natural size and much enlarged.

At right of center ladybird beetles, upper *Platyomus lividigaster*, lower *Cryptolaemus montrouzieri*, much enlarged.

Lower left hand corner, lady bird beetle *Coelophora inequalis*, natural size and much enlarged.





to control the pest when it has spread over the field and when the plants have obtained considerable growth. Not so however if methods of destruction were begun upon its first appearance in the field when the young plants have but little growth and foliage. Spraying at this time will generally save the plants and allow them to grow strong enough to withstand the later broods.

The *Orange Aphis* (*Mysus citricidus*) is another pest which has caused some inquiry, and has annoyed the grower. This pest however is not generally serious enough to cause alarm, only the growth of the young trees would be checked by the attack. Our numerous predaceous insects feeding on this species very soon check their numbers. Truck crops are of course constantly troubled by Aphids and it is generally the small grower or individual who has his patch of vegetables who really notices the damage more than the one who has large acres to handle. Spraying with soap solutions when the plants are small will tend to relieve the situation.

#### *Ants.*

We have three common ants which have given much trouble to the householder, and our assistance has been demanded quite frequently. The common black ant (*Pheidole megacephala*) is more of a garden pest, but frequently invades houses in search of food. The small dark house ant (*Monomorium floricola*) and the small yellow ant (*Monomorium pharaonis*) are both usually found in the pantry or wherever food is stored. These ants are not injurious to plants although many think so. When ants are crawling up into the plant or tree, they are in search of a colony of mealy bugs or plant lice to gather from them the honey dew, the sweet liquid which they exude. Ants frequently loosen the soil around young plants especially near the base and cause them to fall over. The black ant particularly has become very numerous, especially in dry situations, and has caused considerable annoyance to the housekeeper.

Fighting ants in the house may be done in two ways, first, by protecting food material from their attack. This can be done by the use of dishes containing water into which the legs of tables, ice-chests and cupboards may be placed, or tying bands, which are soaked with ant poison, around the legs of tables and other furniture. A very important step is to keep the premises clean and not allow bread crumbs, bits of meat or other particles of food to remain on the floor or table, which will constantly attract the ants. Second, and probably more satisfactory in the end is to endeavor to kill off the colony after finding the nest. Trapping ants with sponges moistened with either sweetened water or diluted bouillon and placed where ants swarm gives good results. After the sponges are covered with ants they can be



picked up and dropped into boiling water and cleaned and the process repeated; in a short time the colony has been so reduced as to give very little trouble for a time being. The nests of the black ant are found outside the building in the ground and the inhabitants can be killed by the use of gasoline or carbon bisulphide. As both of these substances are explosive in the presence of fire, care should be exercised not to use matches or allow smoking when applying them. When the nest is found make three to six holes with a pointed cane or iron rod about ten inches deep and into each put about one ounce of either liquid and then close each hole with some loose earth. This might have to be repeated if the queens have not been killed. The nests of the other house ants are usually behind the baseboards or between the sills and the foundation; sometimes they build between the paper and wooden partitions. A liberal application of either gasoline or kerosene when the nest is found will very often kill off the colony.

#### *White Ants. (Termites).*

The white ants or termites are not very often seen by the occasional observer. They live in colonies and do serious injury to the wooden structure of buildings in which they work unmolested and unobserved. They tunnel in the timbers near the ground at first and gradually work their way into the upper structure of buildings in which they work unmolested and unobserved. They tunnel in the timbers near the ground at first and gradually work their way into the upper structure. One species (*Coptotermes*) has proven very destructive on this Island. This species from all accounts has been in the Territory for many years and was probably brought in here from the Orient or Australasia. In June, 1912, we found a colony in the piling at the very end of Pier No. 7, and through our advice the harbor master at that time succeeded in killing out that colony by using a mixture of equal parts of crude oil and kerosene which was poured into holes bored into the piles. Since then this pest has been reported from the Kamehameha Schools, the Capitol grounds and is now found on several wharfs of Honolulu. When the pest once takes hold of any structure it requires immediate action to stem its destructive work. All infested timbers should be removed and replaced with new ones which have been treated with creosote, crude oil or various other timber preservatives. The pest lives underground, and when a building has a stone foundation it will build mud runways from the ground over the stone to the wood work above it. I am afraid that this pest will prove a serious menace to many wooden structures in Honolulu. It will mean that concrete foundations will have to be used and the open spaces under buildings be made more accessible so as to facilitate fre-

quent inspection. Infested timbers should be carefully removed and immediately burned to avoid carrying the pest to other localities, and the place must be thoroughly treated with creosote, kerosene or other penetrating liquids so as to kill all remaining individuals which have crawled out of the destroyed timber.

#### PINEAPPLE DISEASE.

A very peculiar disease of the pineapple made its appearance on pineapples in some of the fields on the Island of Kauai early in the year of 1913. The Commissioners of the Board of Agriculture and Forestry took immediate steps and passed Rule XVIII on May 24th of that year for the purpose of preventing the disease from spreading from the Island of Kauai to any other of the Islands. Nothing definite is known of the cause of the disease, and no organism has as yet been detected which would throw any light on the subject.

In June, 1914, the same disease made its appearance in a pineapple field on the windward side of Oahu. The Board of Commissioners immediately amended Rule XVIII so as to include the island of Oahu. The disease appears more abundant during the early summer months, May and June. Investigations are being carried on by Dr. H. L. Lyon of the Hawaiian Sugar Planters' Experiment Station, and it is to be hoped that during the coming season a definite cause for the disease will be brought to light. The following is Rule XVIII as amended:

#### Rule XVIII.

Rule and Regulation of the Board of Commissioners of Agriculture and Forestry concerning the control of Fungus Diseases on Pineapples.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby makes the following rule and regulation for the purpose of preventing the spread of a fungus disease upon pineapples which has made its appearance upon the Islands of Kauai and Oahu.

SECTION I. All persons and corporations are hereby prohibited from carrying, transporting or shipping from the Islands of Kauai and Oahu to any other Island in this Territory any pineapple fruit, pineapple plant or pineapple sucker.

SECTION II. No pineapple fruit, pineapple plant or pineapple sucker shipped from any port of the Islands of Kauai or Oahu to any other port in this Territory shall be allowed to be landed. Inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to examine and inspect all freight, baggage and belongings arriving at any port of the Territory from the Islands of Kauai and Oahu and to destroy any and all pineapple fruits, plants or suckers found among such freight, baggage or belongings.

SECTION III. Any person violating the above Rule shall be



guilty of a misdemeanor and upon conviction thereof shall be punished by a fine not to exceed Five Hundred (\$500.00) Dollars as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905, and Act 112 of the Session Laws of 1907.

SECTION IV. This rule shall take effect upon its approval by the Governor.

Approved:

LUCIUS E. PINKHAM,

Governor of Hawaii.

Honolulu, Territory of Hawaii,  
June 30, 1914.

#### RECOMMENDATIONS.

Now that the Panama Canal is open for traffic and owing to the noticeable increase of all classes of shipping, I would recommend that an adequate sum be appropriated so as to safeguard the Plant Quarantine inspection work. The Islands are now in direct communication with Central America, where very serious pests are known to exist. We should be well prepared to handle any and all shipments, whether destined to these islands or whether only in transit. Honolulu being a port of call will mean that many steamers will remain one, two or more days in port, and if any cargo in transit needs our supervision while in port, we should be able to meet the situation by having sufficient men to carry out our work.

Owing to the constant complaint from our citizens regarding the loss and annoyance of the Japanese Rose Beetle, Pink Cotton Boll Worm, the Melon Fly, the Alligator Pear Mealy Bug and the Corn Leaf Hopper, I would recommend that some action be taken by the Board of Commissioners to ask the incoming legislature to provide liberal funds for the search of natural enemies for the above pests. Since the successful introduction of several parasites for the Mediterranean fruit fly has been possible, the growers of crops injured by the above named pests are deeply interested and are anxious that something be done on similar lines to relieve their situation and if possible spare them their annual loss.

Respectfully submitted,

EDWARD M. EHRHORN.

Superintendent of Entomology.

## DIVISION OF ENTOMOLOGY

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### REPORT OF THE WORK OF THE INSECTARY

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Honolulu, Hawaii, December 31, 1914.

To the Superintendent of Entomology,  
Board of Commissioners of Agriculture and Forestry,  
Honolulu, T. H.

Sir:

I submit herewith a report on the operations of the insectary during the biennial period ending December 31, 1914. Before proceeding to the detailed account of the work I wish to refer briefly to the circumstances which led to the establishment of the insectary. You will recall that at the close of 1912 the Board was conducting a campaign against the fruit fly in which dependence for its control in and about Honolulu was placed on the destruction of wormy fruit and the poisoning of adult flies. Although the work was done with great thoroughness and had the sanction both of reason and experience, the results obtained were entirely disappointing, and it was felt that sooner or later it would have to be abandoned. About this time the President and the Executive Officer of the Board, Mr. W. M. Giffard, decided to attempt the introduction of parasites, and while casting about to see what could be done in this way, was fortunate enough to get into communication with a man who already had considerable experience with fruit flies and their natural enemies, namely, Prof. Filippo Silvestri of Naples, Italy. After considerable correspondence and exchange of views on the subject Prof. Silvestri was engaged to make a search for fruit fly parasites in tropical West Africa, this region being selected for exploration first because the bulk of the species of *Ceratitis* are found there. Prof. Silvestri left Naples in July of 1913, visited and investigated practically every colony along the West coast of Africa from Senegal to the Cape, finding evidence of abundant parasitism of fruit flies; and after seven months in the field came to Honolulu via Australia with living specimens of three larval and two pupal parasites and information in regard to nine other larval and three other pupal parasites, some of which he attempted to bring with him but lost *en route*. A full account of Silvestri's travels and observations is found in Entomological Bulletin No. 3 of this Board. It was in preparation for Prof. Silvestri's arrival and to



take care of his parasite material that the insectary was built and equipped, and while little was known regarding the requirements of the work previous to his arrival the insectary proved entirely adequate and gave the greatest facility to the work of multiplying the parasites, which it was necessary to do before it could be expected to liberate them out-of-doors.

The two classes of parasites, larval and pupal, one laying their eggs in the worm through the skin of the fruit, the other in exposed pupae, required somewhat different handling. The host material of the latter was prepared by laying infested fruit on sand and sifting out the pupae. The former were placed inside cages with the wormy fruit itself.

The larval parasites, owing to the small numbers we had to work with and our inexperience in the matter of cages, slowly dwindled instead of multiplying and were finally lost altogether in the insectary, but not before a few individuals of the South African and Australian species had been liberated under tents in the coffee fields of Kona. This "log shot" on the establishment of the species, as will appear later, was a most fortunate move.

The pupal parasites, on the other hand, propagated well from the start and in a short time were being produced in thousands. The aim of the work in the insectary was to increase the number of parasites as rapidly as possible so as to be able to liberate large colonies in favored places on the different islands, which could by sheer force of numbers overcome the element of chance and bring about a quick and widespread establishment; and the criterion of this fact was to be the recovery of the species in nature.

As already stated, the work with the larval parasites came to an end abruptly when there were no more females to propagate the species, but not so with the pupal parasites; and in carrying out the original intention to continue multiplying and distributing the parasites until they were recovered outside, these two species were produced in enormous numbers, 73,639 by the end of 1913, when the breeding work was slackened down to a minimum; and they are still being produced in small numbers as neither species has yet been recovered in nature. I cannot at present think otherwise than that these species have really become established, but owing to the difficulties in the way of testing the question we may have to wait some time until chance brings us the proof.

No attempt was made to recover the larval parasites until October of that year when some infested coffee berries were sent to the insectary by the Board's agent in Kona. To the astonishment of everyone this material yielded a large number of the South African species. These were multiplied in the insectary without further trouble, and good sized colonies were later distributed to every fruit growing section in the Islands.



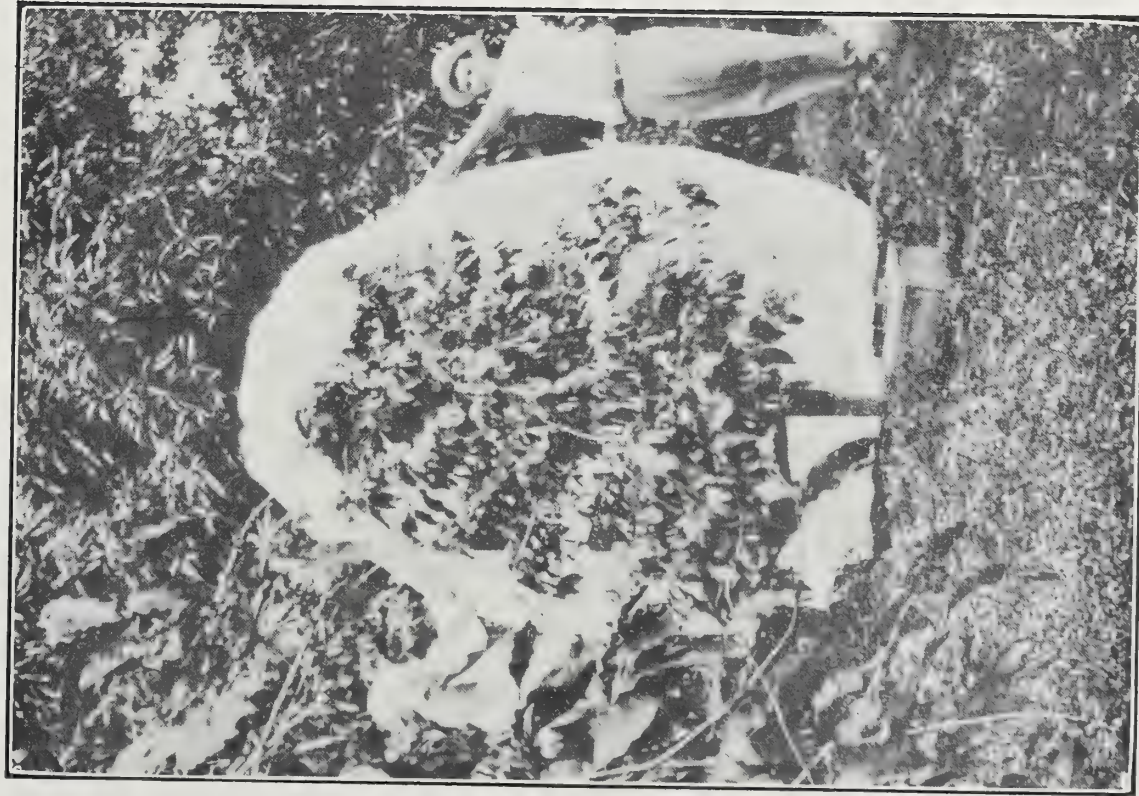


Plate 18.  
Fig. 1. Adjusting Tent.



Method of liberating larval parasites of the fruit fly.

Fig. 2. Tent in place with parasites confined.





Some other parasites and predators have also been handled in the insectary. A Dung Fly parasite (*Muscidifurax vorax*), brought by Prof. Silvestri from South Africa, has been produced by the thousands (76,279 at the close of 1913), and liberated in stables about Honolulu and on all the large cattle ranches on the Island. Two other Dung fly parasites (*Pteromalus sp.* and *Spalangia sp.*) brought by the writer from the Philippine Islands in the early part of 1914, were multiplied in large numbers and distributed in similar places, and a coccinellid beetle (*Scymnus bipunctatus*) feeding on mealy bugs was brought at the same time and liberated at various places around Honolulu. Later on, through an arrangement made with Prof. Silvestri, some work was undertaken on Horn Fly enemies in North Africa, and as a result of this the insectary was in receipt during the six months from January to July of various consignments of *Staphylinid* beetles, which are predatory on Dung Fly larvae and pupae. These beetles came mostly in very poor shape but all that were in a living condition were liberated in cow pastures where the conditions were suitable for their propagation.

I have recently had tables prepared to indicate the extent of the distribution of the different fruit fly and dung fly parasites, and an examination of these tables shows that good sized colonies of the parasites have been liberated in the following places:

#### FRUIT FLY PARASITES.

Hawaii  
Kealakekua  
Onouli  
Honaunau  
Keōpu  
Kiilae  
Kealia  
Holualoa  
Kahaluu  
Kaumalumalu  
Kailua  
Waiaha  
Kainaliu  
Keauhou  
Kohala  
Waimea  
Hilo  
Wainaku  
Kahaiau  
Paauilo  
Honokaa  
Pahala  
Naalehu

Oahu  
Honolulu  
Waikakalaua  
Waianae  
Waiahole  
Kualoa  
Maunawili  
Hauula  
Pearl City

Kauai  
Waimea  
Lihue  
Hanalei  
Wahiawa  
Koloa  
Lawai  
Kalakeo  
Kealia

Maui  
Lahaina  
Honolua  
Kahilipali  
Wailuku  
Makawao  
Haiku  
  
Molokai  
  
E. Molokai (Meyers)  
W. Molokai (Hitchcock's) (Conradt's)  
Mapulehu Gulch



## HORN FLY PARASITES.

<b>Hawaii</b>	<b>Oahu</b>	<b>Maui</b>
Kamuela	Honolulu	Pohakupule
Puna (Shipman's)	Niu	Makawao
Kau (Monsarrat's)	Honouliuli	Paia
Pahala	Kunea	Waiohula
Naalehu	Kawailoa	Ulupalakua
Kona (Geenwell's)	Waialae	Kahikinui
(Paris')	Waimea	
Puuhi	Kahuku	<b>Molokai</b>
Puuwaawaa	Mokuleia	Pukoo
Hilo	Kualoa	Kamalo
Kohala	Waianae	Koluaha
Kukaiau	Koko Head	Mapulehu
Olaa	Robinson Station	Kaunakakai
	Hauula	Kalaupapa
<b>Kauai</b>	Maunawili	
Waimea		
Lihue	<b>Lanai</b>	
	Keomoku	

The promising nature of the field developed by Silvestri led the Board to dispatch a second expedition to West Africa which left in June of last year. The writer and J. C. Bridwell went out this time, Prof. Silvestri being unable to obtain a leave of absence from the government school where he is employed. The main object of the second expedition was to get as many as possible of the parasites observed by Silvestri on the previous excursion and any others which might be discovered by us. The expedition started out under most favorable circumstances, as we knew exactly what was wanted, how to get it, and in a large measure how to handle the parasites when secured. It was also possible by making personal representations to the American Government at Washington and to the British Government at London, to get first class credentials, which are so necessary in travelling abroad and especially in West African colonies. The British Colonial office also recommended us to the Governors of all the British colonies along the West Coast for such assistance as it was within their ability to give, and we were able to make excellent financial arrangements through the office of the Bank of British West Africa in London. Most of the equipment was secured in London at reduced rates from the Army and Navy Stores. We sailed from Liverpool on the 8th of July, touching at Teneriffe, Canary Islands, on the 14th; Freetown in Sierra Leone on the 19th; and arrived at Lagos, Nigeria, July 24th. As information obtained from Silvestri made it extremely doubtful whether we could secure a colony of the Mediterranean fruit fly in Nigeria a good supply was obtained in Teneriffe and taken with us. On arrival at Lagos we went immediately to the office of the Colonial Secretary, who promised us all the assistance the Government could give, and wired immedi-

ately to the Director of the Forestry Station at Olokemeji to place the facilities of the station at our disposal. The following two days were spent investigating fruit conditions around Lagos. Only cultivated fruits were observed and these were scarce. Most of the fruits were green, but we found a few ripe mangoes and some pitanga cherries which yielded the Mediterranean fruit flies in small numbers. A single specimen of an undetermined *Opius* was captured alive by Mr. Bridwell in the Experimental Gardens at Ebute-Metta. On the morning of July 27 we took the train from Lagos for Olokemeji, about one hundred miles inland, arriving in the afternoon and were met at the station by Mr. R. E. Dennett, acting director, who installed us temporarily in the residence of the director and later gave us an unoccupied house on a neighboring hill in the midst of the native forests, to use as a residence and laboratory. By the 29th we were settled down to work. From this date to the 17th of August our time was spent in making daily searches through the forests and fields in the neighborhood of Olokemeji for fruit infested with fruit fly maggots, and collecting and studying as far as possible the hymenopterous parasites of that region. We were unable to find all the cultivated fruits in the forestry station grounds referred to by Prof. Silvestri, but daily ran across some new and unfamiliar fruit in the forests, some of which contained maggots. In open and neglected places overgrown with weeds and in a few abandoned fields we found one fruit very abundant—a small cucurbit of the genus *Momordica* which contained trypetid larvae, and on the Saturday after our arrival I observed and captured a few individuals of the small chalcid parasite described by Prof. Silvestri as *Tetrastichus giffardi*, on fruit of this cucurbit. As this parasite was considered by Silvestri to be one of the most efficient checks on the multiplication of fruit flies in Africa, and as we had been especially commissioned to get it on this occasion, I immediately set to work to gather all the fruits of this plant that I could find, and inside of a week had several thousand pupae out of them. It is a peculiarity of the parasite referred to that the later stages of its development can be observed through the skin of the host, and our delight was boundless when at the expiration of ten days we could see that a large proportion of the pupae we had collected were parasitized. By the 15th of the month we had several thousand additional pupae, and as we had planned on coming out to colonize this parasite in the Canaries in the fall and send it by mail to Honolulu through the winter, I immediately made plans to leave for the Canary Islands. Such equipment as was needed was hastily got together and packed along with all the parasitic material that could be obtained, and on the morning of the 18th I took the train for Lagos, sailing the following day on the S. S.



Abosso for Teneriffe. On the second day out the parasites began to emerge from the older material and continued to come out for ten days or more. Somewhat to my surprise the material produced in addition to *Tetrastichus* two Braconid species, quite readily distinguished by their color, one being black, the other a brownish yellow. The latter was afterwards determined to be *Diachasma fullawayi*, a species discovered by Prof. Silvestri on the previous trip; the black species is possibly new. I had, then, as a result of the few weeks spent in Nigeria, *Tetrastichus*, three *Opius* forms (counting the individual taken alive by Bridwell in Ebute-Metta) and a few individuals of a *Spalangia* found in working over the infested fruits of the Momordica. These parasites were kept alive in glass tubes stoppered with cotton by feeding them honey placed in small drops on the leaves of an evergreen shrub which was carried along with me. On the morning of the 24th we touched at Freetown, Sierra Leone, and I was here obliged to leave the ship and go ashore, as cable orders had been received from the British Admiralty directing the ship to proceed at once to Liverpool for trooping, without calling at Teneriffe. The next day, however, a freighter appeared which would call at Teneriffe, and I embarked that afternoon on the S. S. Eboe, the vessel sailing the following morning. The passage from Sierra Leone to Teneriffe, which is ordinarily made in six days, was now lengthened out to twelve, as our carrier, being a freighter, was obliged to call at Conakry, Dakar and Bathurst for cargo on the way up. But this delay while it caused me a great deal of anxiety on account of the possibility of the parasites dying *en route*, gave me time to conduct some experiments with *Tetrastichus* in the Mediterranean fruit fly, which I had been breeding in storage apples since our arrival at Olokemeji. Before reaching Teneriffe, therefore, I was able to determine (1) that *Tetrastichus giffardi* was a larval parasite, ovipositing in worms half to full grown, (2) that it would parasitize the Mediterranean fruit fly; and (3) that it was a primary parasite, since it bred in *Ceratitis capitata* in pure culture; besides getting a new lot of parasites from individuals used in the experiment.

We arrived in Teneriffe the morning of September 5th, and after unpacking my equipment and arranging a temporary laboratory at the hotel, I went to the fruit markets to see if suitable fruits could be obtained for the propagation of the parasites. Fruit was very abundant in the markets, but peaches were the only kind that was heavily infested and suitable for the work. I began the multiplication of the parasites at once, and in three weeks had accumulated a large amount of material.

I had planned on leaving Bridwell to remain in Teneriffe until he should join me in November, but information received

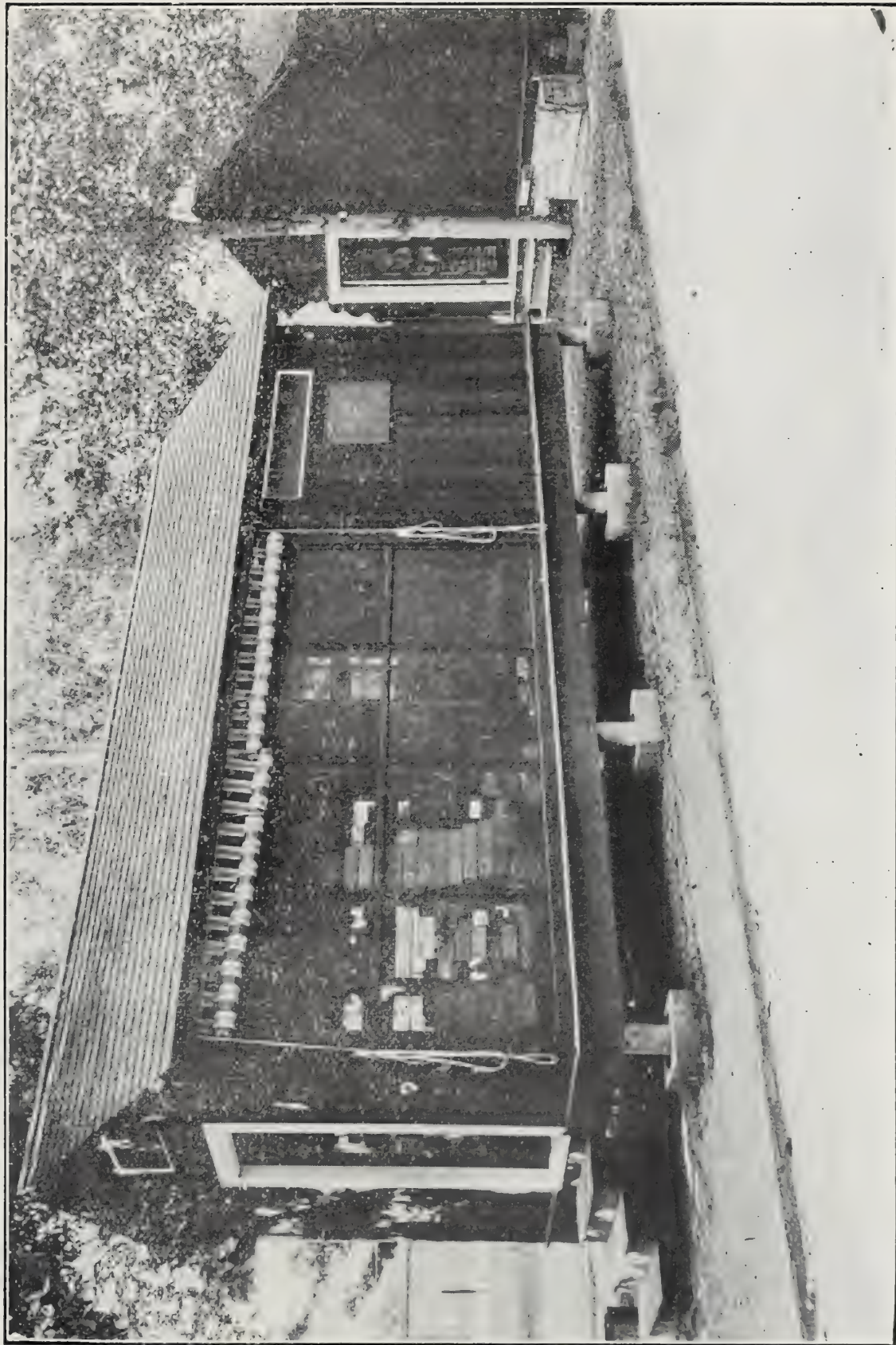


Plate 19. Insectary used for the propagation of introduced parasites.





from the American Consul in regard to the low temperatures during the fall and winter months and the interruption in the steamship service due to the war led me to abandon these plans, and as soon as I had ascertained that the parasites were developing in the Teneriffe material I decided to strike out for home. After notifying Bridwell of the change of plans I took a French steamer, the Mexican, on the 27th of September for Havana, Cuba, reaching that port on the morning of the 15th of October. From Havana I took a steamer for Key West, Florida, and came thence by train through Jacksonville, Montgomery and New Orleans to San Francisco, arriving in time to take the S. S. *Wilhelmina* for Honolulu, where I landed on the 27th of October with the following:

300 male and female *Tetrastichus giffardi*,

12 female and 19 male *Diachasma fullawayi*,

4 female and 22 male *Opius*, species undetermined,

10 female and 2 male *Spalangia*, species undetermined;

also some parasitized pupae bred *en route*. Mr. Ehrhorn, being advised of my coming by wireless, had collected a large supply of infested fruits. On the morning following my arrival I began multiplying the parasites in order to get large numbers for liberation, and this work has been going on continuously ever since. Mr. Bridwell is still in the field and is expected home sometime in March. His orders were to remain at Olokemeji for at least three months, to pay particular attention to the Braconid parasites of the fruit flies, and to make every possible endeavor to discover egg parasites. At last report he was in South Africa multiplying the parasites secured in Nigeria and investigating the South African field.

Of the four species brought to Honolulu by myself one—the black *Opius*—produced only males in the first generation and was lost to us unless it is among the species which Bridwell has. The others have multiplied satisfactorily, 419 females and about 1000 males of *Diachasma fullawayi*, 21,431 *Tetrastichus* and 7 *Spalangia* having been produced at the time of this writing. Liberations have been made as follows:



## TETRASTICHUS GIFFARDI

<b>Oahu</b>			
Nuuanu	.....	12,300	
Manoa	.....	950	
Moanalua	.....	1,000	
Pearl City	.....	200	14,450
		<hr/>	
<b>Hawaii</b>			
Kona	.....	1,800	
Hilo	.....	1,000	2,800
		<hr/>	
<b>Kauai</b>			
Lihue	.....	800	800
		<hr/>	
Total	.....		18,050

## DIACHASMA FULLAWAYI

<b>Oahu</b>			
Maunawili	.....	35	
<b>Hawaii</b>			
Kona	.....	160	195
		<hr/>	
Total	.....		195

The present purpose is to continue multiplying these parasites similarly to the others, until we can ascertain that they are established in nature. In August of 1914 the Australian *Opius* (*Diachasma tryoni*) which was liberated in Kona at the same time as the South African species, was also recovered and is now known to be well established all through the coffee fields of that district. We are endeavoring to multiply it in the insectary from specimens brought from Kona by Dr. Back, in order to establish it on Oahu and eventually on all of the other Islands.

The great reduction of flies which has been brought about by the parasitism of these species is already being noticed by even the casual observer. The depletion in numbers is naturally much more marked in Kona, where the fly had unusual opportunities to increase before the introduction and establishment of the parasites. Dr. Back, on a recent visit to Kona, was so impressed by the altered condition that he set to work to secure data on the extent of the parasitism, both in Kona and in Honolulu, and I am indebted to him for the opportunity of presenting the appended table showing the percentages of parasitism in the two districts, in different fruits and in large and small quantities of each fruit. It will be noticed that some of the lots produced as high as 50 per cent of parasitism from one species, though the average out of all kinds of fruit is only about 15 per cent. In Kona the parasitism is even somewhat higher.

It is particularly gratifying to those who planned and carried

out this work to see the present measure of achievement come so soon, and it is earnestly hoped that the Board will see the usefulness of this line of work in connection with the Entomological Division and make every effort to have it continued.

The principal participants in the work have already been mentioned, but it would be unfair to pass without notice the contributions of a number of men throughout the Territory who have helped materially in getting results. The most active of these were Messrs. J. P. Curts and Robert Wallace of Kona, Hawaii, Mr. John Herd of Maunawili Ranch, Oahu, and Mr. Frederick Meyer of Waianae, Oahu. There are also many others who cannot be mentioned by name, but to all we wish to make grateful acknowledgment.

Respectfully submitted,

D. T. FULLAWAY,

Field Entomologist.





**Parasitism Among the Larvae of the Mediter-  
ranean Fruit Fly (*C. Capitata*) in Hawaii  
During 1914**

BY

E. A. BACK AND C. E. PEMBERTON,  
Bureau of Entomology,  
United States Department of Agriculture.

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W. M. Giffard, Esq.,  
President and Executive Officer,  
Board of Agriculture and Forestry,  
Honolulu, T. H.

Sir:

It will be recalled that at the time the Federal Bureau of Entomology began its investigation of the Mediterranean Fruit Fly (*Ceratitis capitata*) in the Hawaiian Islands in August, 1912, you made the request of Mr. C. L. Marlatt, Assistant Chief of the Bureau of Entomology, and entomologist directly in charge of this investigation, that the Bureau leave to your Board the problem of finding, introducing and establishing parasites of this pest in Hawaii, inasmuch as your Board had already engaged the services of Dr. F. Silvestri for this purpose. The writers have, therefore, confined their efforts to other phases of investigational work, and such information as they have secured has been obtained quite incidentally to their other work. They have, however, been forced recently to take an added interest in the parasites introduced and established by the very frequent occurrence of parasites among the fruit flies used in their experimental work, and in the marked decrease of the pest in certain districts with the resulting effect upon the degree of infestation of host flies.

This active interest began during July, 1914, when the writers were confronted in their biological work with a parasitism ranging from 29 per cent to 53.8 per cent among certain pupae derived from strawberry guavas (*Psidium cattleianum*). Since that time it has been the custom of the writers to take from lots



of pupae obtained for experimental purposes, samples which were placed in covered jars. These samples were allowed to remain in their containers until all emergence had ceased, when they were emptied separately into large pill boxes, properly labelled, and set aside until such time as the laboratory force could make the counts necessary to determine the percentages of parasitism. Since the few examinations that were made during July indicated that the average parasitism did not exceed 3 per cent, the percentages just determined are a pleasant surprise, and are here presented, at your request, and with the approval of the Federal Bureau. While it is too early yet to predict that the Mediterranean Fruit Fly will be satisfactorily controlled by introduced parasites, there can be no question but that the South African parasite, *Opius humilis*, alone, is partially, if not entirely, responsible for the noticeable decrease in fruit fly abundance in certain localities, and that the moneys appropriated by your Board for parasitic work have already yielded most gratifying results.

In presenting these data on parasites it should be mentioned that all have been obtained from material gathered within the limits of Honolulu with the exception of those resulting from an investigation of the fruit fly in coffee in the Kona District during October and November. Aside from the comparatively few specimens of the Australian parasite, *Diachasma tryoni*, bred from the Kona material no introduced parasite has been bred but the South African, *Opius humilis*. As no specimens of this latter species were liberated on the Island of Oahu previous to November and December, 1913, the Honolulu data form a distinct addition to our knowledge of the multiplication of this parasite during the first year after its liberation, and will play an important part in determining the increase in its efficiency during coming years.

Before introducing the percentages to which reference has been made, the writers wish to bring out two additional points: first, that during the year and a half previous to the liberation of introduced parasites in Honolulu, and previous to the liberation of these parasites at any other points in the Islands where federal work had been carried on, the writers had at no time bred *Opius* or *Diachasma*, whereas at the time of this writing (December, 1914) parasites are bred from practically every lot of fruit flies brought to the laboratory from localities where parasites have been liberated; second, that complete justice is not done the parasites in every instance recorded in Tables II to V. This is due to the fact that both *Opius humilis* and *Diachasma tryoni* parasitize only, or for the most part, the medium sized or well grown larvae of the fruit fly. Thus if any lot of fruit be placed in a container and allowed to remain until all larvae have emerged and pupated, the percentage of parasitism obtained from

the total number of pupae secured is less than would have been the case had the fruit been left to ripen on the tree and fall normally, thus giving the parasites opportunity to attack as they developed those larvae that were too small for them at the time the fruit was gathered. The writers secured larvae at the insectary as they emerged from the fruits daily. It is evident, therefore, that, as larvae do not generally emerge from fruits until they are full grown, the last larvae to be secured from any lot of fruit would show no parasitism, or a parasitism very much less than would the larvae emerging during the first few days after the gathering of the fruit. This point is made clear by the data in Table I, secured from larvae emerging from coffee cherries picked in Kona, Hawaii.

TABLE I. Parasitism among larvae developing in coffee grown in Kona, Hawaii.

Coffee grown at	Date of collection of sample	Larvae emerged between	Percentage of larvae parasitised by		Total percentage of parasitism
			<i>Opius humilis</i>	<i>D. tryoni</i>	
Kahului	Oct. 31	Oct. 31—Nov. 3	31.2	21.8	53.0
		Nov. 3—Nov. 6	20.	12.3	32.3
		Nov. 6—Nov. 9	5.3	.7	6.0
		Nov. 9—Nov. 11	0.0	.0	0.0
Hookena	Oct. 31	Oct. 31—Nov. 3	16.7	40.7	57.4
		Nov. 3—Nov. 6	17.0	19.0	36.0
		Nov. 6—Nov. 9	1.2	0.0	1.2
		Nov. 9—Nov. 11	0.0	0.0	0.0
Kahalua	Oct. 30	Oct. 30—Nov. 8	80.4	2.2	82.6
		Nov. 3—Nov. 6	23.3	0.4	23.7
		Nov. 6—Nov. 9	3.7	0.0	3.7
		Nov. 9—Nov. 11	0.0	0.0	0.0
Keauhou	Oct. 30	Oct. 30—Nov. 3	85.2	0.0	85.2
		Nov. 3—Nov. 7	55.2	0.0	55.2
		Nov. 7—Nov. 9	6.7	0.0	6.7
		Nov. 9—Nov. 11	3.7	0.0	3.7

The data in Table I leave no doubt that only those percentages of parasitism secured from larvae emerging soon after the fruit is gathered represent the real effectiveness of the parasites for any particular lot of fruit. And it is because this fact was not fully appreciated by the writers until the above data were secured that they are not able to state definitely that each percentage recorded in Tables II.-V. is based upon the first lot of larvae secured from each lot of fruit. Often samples of fruit were taken at frequent intervals from the same locality, hence elimination of all but first



emergence records has been difficult. It can be stated, however, that all negative results recorded in these tables are first emergence records. In the main the percentages in Tables II.-V. are believed to contain very few but first emergence records and fairly represent the control exerted by *Opius humilis* in Honolulu during the months covered. There has been found a wide range in parasitism even among larvae first emerging from the fruit taken at different times from the same tree, thus proving that no percentage, no matter how high or how low, can be taken as representative of any particular locality.

Percentages of parasitism have not been secured for larvae emerging from all host fruits. Parasites have been bred from larvae developing in the ball kamani (*Callophyllum inophyllum*), the Carambola (*Averrhoa carambola*), the Chinese orange (*Citrus japonica*), coffee (*Coffea arabica*), Eugenia (*Eugenia michelii*), mangoes (*Mangifera indica*), *Mimusops elengi*, Natal plum (*Bunchosia* sp.) *Ochrosia*, the peach (*Amygdalus persica*), the rose apple (*Eugenia jambosa*), the strawberry guava (*Psidium cattleyanum*), the Bestill (*Thevetia neriifolia*), and the winged kamani (*Terminalia catappa*). Only the percentages secured from larvae developing in coffee, chinese oranges, strawberry guavas, bestills and winged kamanis have been tabulated (see Tables I.V.). Other data are given below:

*Ball kamani.* One hundred and three larvae emerging from samples of fruit gathered on August 15 in Nuuanu Cemetery showed a parasitism of 1.1 per cent.

*Carambola.* Larvae emerging during late September from fruit gathered at 1516 Beretania St., Punahou Street, Maguire and Spencer Streets, and 1008 Kapiolani St. showed a parasitism of 45.4, 6.2, 75 and 12.5 per cent respectively.

*Coffee.* The percentages given in Table I. show that parasitism in Kona is very high. Larvae emerging from coffee cherries gathered about the middle of November at Lanihau, Kahaloa, Keei Mormon Church, and Kealakekua showed a parasitism of 97.8, 93.1, 83.4 and 76.6 per cent respectively. Samples of cherries collected on October 30 and 31 at Honalu, Honaunau, Lanihau, first Holualoa store, second Holualoa store, Kainaliu and Kalaua yielded larvae showing a parasitism of 84.6, 70.9, 70, 34, 59.8, 75 and 66.7 per cent respectively. The percentages of parasitism among larvae in Kona coffee ran consistently high. This is due in all probability to the abundance of fruit fly larvae and coffee, and the ease with which the parasite can reach its host through the thin skin of the coffee cherry. Larvae emerging in Honolulu from cherries gathered during September from Judd and Liliha Streets (two samples); Maternity Home, Beretania St.; Booth Estate, Pauoa Road, and at 1972 Pauoa Road showed a parasitism

of 39.5, 24.3, 3.9, 5.1 and 25.3 per cent respectively.

*Eugenia*. Two samples of fruit gathered at Victoria and Beretania Streets during September yielded larvae showing a parasitism of 9.5 and 6.1 per cent respectively.

*Mangoes*. Seven lots of mangoes collected in Honolulu, locality unrecorded, during July and August yielded larvae showing a parasitism of 1.5, 3, 0, 7.1, 10.4, 0 and 0 per cent respectively.

*Mimusops elengi*. Over three hundred larvae emerging from two lots of this fruit gathered at Queen's Hospital during July yielded no parasites.

*Natal Plum*. Larvae emerging from one lot of this fruit gathered at Kalihi near Thomas' Pineapple Cannery showed a parasitism of 6.1 per cent.

*Ochrosia*. Larvae emerging from lots of this fruit gathered during August from Spreckels' Estate, Punahou St., and from the grounds of the Board of Agriculture and Forestry showed a parasitism of 29 per cent and 0 per cent respectively.

*Peach*. From 2,301 larvae emerging during July from peaches grown at Kaala Avenue and Vancouver Highway, no parasites developed.

*Rose Apple*. Fruit gathered from 9118 Pauoa Road and Pauoa Valley opposite church, yielded larvae showing a parasitism of 0 per cent and 40 per cent respectively.

TABLE II. Percentage of Parasitism among *C. capitata* larvae developing in Chinese oranges (*Citrus japonica*).

Date of Larval Emergence	Locality	Number of Specimens Bred		Percent- age of Parasit- ism
		<i>C. Capi- tata</i>	<i>O. Humilis</i>	
August 3	Manoa Valley .....	27	2	13.80
" 5	" " .....	27	1	3.60
" 24	" " .....	50	1	2.00
" 28	" " .....	376	4	1.05
Sept. 2	Punahou Street .....	171	5	2.80
" 7	Beretania Street .....	41	3	6.80
" 8	Punahou Street .....	17	2	10.50
" 10	" " .....	22	3	12.10
" 11	Beretania Street .....	26	2	7.1
" 12	Punahou Street .....	26	32	55.20
" 16	1516 Beretania Street ...	43	3	6.50
" 17	Kapahula St. ....	15	2	11.60
" 18	Punahou Street .....	31	1	3.10
" 25	957 Prospect .....	6	0	.00
" 28	King and Alapai .....	23	1	4.17
" 29	957 Prospect .....	40	1	2.44
" 29	Punahou St. ....	17	2	10.50
" 30	957 Prospect .....	8	2	20.00



TABLE III. Percentage of Parasitism among *C. capitata* larvae developing in Strawberry Guavas. (*Psidium cattleianum*).

Date of Larval Emerg- ence		Locality	Number of Specimens Bred		Percent- age of Parasit- ism
			<i>C. Capi- tata</i>	<i>O. Humilis</i>	
July	16	Manoa Valley .....	156	0	.00
"	23	" " .....	362	0	.00
"	27	" " .....	288	92	29.00
"	30	" " .....	380	218	35.00
"	31	" " .....	244	287	53.86
Aug.	5	" " .....	953	183	16.11
"	7	" " .....	550	173	24.00
"	8	" " .....	1,341	200	12.98
"	11	" " .....	1,063	32	2.92
"	29	" " .....	48	12	20.00
"	29	Punahou St. ....	95	3	3.00
"	31	" " .....	300	1	.33
"	31	Dominis St. ....	232	6	2.52
Sept.	1	" " .....	99	0	.00
"	1	Punahou St. ....	101	4	3.81
"	2	Dominis St. ....	68	7	9.50
"	3	" " .....	21	3	12.50
"	3	Punahou Street .....	60	3	4.76
"	7	" " .....	18	1	5.26
"	8	King and Punahou Sts. ..	0	4	100.00
"	8	Beretania and Hotel ....	50	11	18.00
"	9	" and Punahou Sts. ..	40	4	9.10
"	11	1516 Beretania St. ....	6	1	14.30
"	11	King and Punahou .....	31	51	62.20
"	11	Beretania St. ....	98	2	2.00
"	12	" " .....	98	2	2.00
"	12	" " .....	62	75	54.70
"	12	Punahou St. ....	39	0	.00
"	14	Beretania St. ....	34	4	10.52
"	14	King and Punahou .....	154	86	36.00
"	15	1516 Beretania .....	233	57	19.50
"	15	Judd St. ....	11	1	8.30
"	15	Puunui St. ....	19	1	5.00
"	16	King and Punahou .....	35	57	62.00
"	16	King and Punahou Sts. ..	123	20	14.00
"	17	1516 Beretania St. ....	51	1	1.90
"	18	" " .....	17	2	10.50
"	19	Bates St. ....	22	1	4.30
"	19	Keeaumoku St. ....	40	2	4.00
"	19	Georgia St. ....	6	0	.00
"	22	130 Bates St. ....	43	6	12.29
"	22	1421 Piikoi St. ....	41	11	21.10
"	24	" " .....	13	1	7.10
"	25	" " .....	11	3	21.43
"	25	130 Bates St. ....	11	4	26.60
"	26	Kapiolani St. ....	96	2	2.00
"	28	1421 Piikoi St. ....	29	8	21.60
"	29	Kapiolani St. ....	39	1	2.50
"	30	King and Alapai St. ....	15	0	.00
"	30	Victoria and Beretania ..	8	0	.00

TABLE IV. Percentage of Parasitism among *C. Capitata* larvae developing in Bestills (*Thevetia neriifolia*).

Date of Larval Emergence	Locality	Number of Specimens Bred		Percent- age of Parasit- ism
		<i>C. Capi- tata</i>	<i>O. Humilis</i>	
Aug. 12	Manoa Valley .....	123	4	3.15
" 24	Waikiki .....	250	3	1.19
" 28	Manoa Valley .....	304	0	.00
" 28	Pauoa Valley .....	99	21	17.50
Sept. 1	Manoa Valley .....	194	2	1.00
" 4	Moiliili .....	273	8	3.00
" 7	Manoa Valley .....	272	0	.00
" 7	Pawaa Jct. ....	82	0	.00
" 8	Artesian and Young .....	25	0	.00
" 11	Punahou St. ....	67	0	.00
" 11	Fort and Piikoi .....	114	1	.90
" 11	Pawaa Jct. ....	182	0	.00
" 11	Moiliili .....	92	5	5.10
" 12	Punahou St. ....	16	11	40.70
" 15	1315 Wilder Ave. ....	11	1	8.30
" 15	Piikoi and Wilder .....	49	2	3.90
" 15	Magazine and Spencer ..	7	18	72.00
" 15	Prospect St. ....	12	4	25.00
" 15	Pauoa Valley .....	38	1	2.60
" 15	2425 Nuuanu St. ....	125	2	1.57
" 15	2268 Nuuanu St. ....	61	0	.00
" 15	Lunalilo Home .....	42	10	19.20
" 15	2048 Nuuanu St. ....	15	0	.00
" 15	Queen's Hospital .....	4	6	60.00
" 16	Liliha St. ....	14	4	2.20
" 16	76 Judd St. ....	5	0	.00
" 16	Moiliili .....	65	13	16.60
" 16	Pawaa Jct. ....	13	0	.00
" 16	Queen's Hospital .....	91	10	9.90
" 17	Kawaiahao Cemetery ..	79	12	13.10
" 17	98 Kamehameha IV. Rd.	164	11	6.30
" 18	Kalakaua Ave. and King	5	4	44.40
" 18	Pawaa Jct. ....	17	0	.00
" 23	Ainahau and Kalakaua ..	4	6	60.00
" 26	" " .....	42	1	2.30
" 28	Maguire and Spencer Sts.	3	1	25.00
Oct. 7	Pauoa Church .....	24	0	.00
" 7	St. Mary's Mission .....	6	0	.00
" 7	Kewalo and Wilder Ave.	31	7	18.40
" 7	Fort and Vineyard Sts...	187	0	.00
" 7	Makiki Cemetery .....	56	0	.00
" 7	Iwilei .....	39	0	.00
" 7	1125 Lunalilo St. ....	36	3	7.70
" 7	Pawaa Jct. ....	26	9	25.00
" 7	1315 Wilder Ave. ....	28	3	9.80
" 7	1125 Lunalilo Street ....	46	18	28.10
" 7	1412 Gulick Ave. ....	13	8	66.10
" 7	2001 Beckley St. ....	20	6	23.10
" 7	Sing Loy Lane .....	89	8	9.20
" 7	Kawaiahao Cemetery ...	11	1	8.30
" 7	Makiki Cemetery .....	105	0	.00
" 7	Piikoi St. ....	28	0	.00



TABLE V. Percentage of Parasitism among *C. Capitata* larvae developing in Winged Kamani (*Terminalia catappa*).

Date of Larval Emerg- ence	Locality	Number of Specimens Bred		Percent- age of Parasit- ism
		<i>C. Capi- tata</i>	<i>O. Humilis</i>	
Aug. 6	Pawaa Jct. ....	321	12	3.60
" 20	Waikiki ....	1,670	17	1.00
" 22	Pawaa Jct. ....	1,050	25	2.30
" 28	Punahou St. nr. Beretania	969	78	7.40
" 28	Pauoa Valley ....	144	9	5.80
Sept. 1	Punahou ....	1,202	71	5.57
" 2	" ....	683	43	5.93
" 2	Waikiki ....	1,134	4	.35
" 3	Pawaa Jct. ....	952	7	.72
" 3	Punahou St. ....	1,057	47	4.25
" 7	Piikoi St. ....	130	10	7.10
" 7	Beretania and Hotel St..	56	0	.00
" 7	Georgia St. ....	40	27	40.30
" 7	Puunui St. ....	803	97	10.80
" 8	" ....	239	34	12.40
" 8	Moana Hotel ....	56	4	6.60
" 9	Piikoi ....	57	2	3.40
" 8	Pawaa Jct. ....	129	1	.80
" 9	Waikiki ....	847	28	3.30
" 10	Pawaa Jct. ....	200	23	10.30
" 10	Moana Hotel ....	506	6	.98
" 10	Punahou College ....	126	14	10.00
" 11	Piikoi St. ....	166	42	20.20
" 11	Beretania and Punahou..	96	4	4.00
" 12	Moana Hotel ....	121	11	8.30
" 12	Pawaa Jct. ....	168	4	2.30
" 12	Queen's Hospital ....	93	11	10.10
" 12	Georgia St. ....	32	13	29.00
" 12	Punahou and Wilder ....	12	6	33.30
" 12	Richards St. ....	22	8	26.60
" 14	" ....	61	26	29.90
" 14	Queen's Hospital ....	30	8	21.10
" 14	Emma St. ....	7	7	50.00
" 14	Pawaa Jct. ....	124	7	5.40
" 14	Nuuanu Cemetery ....	31	15	32.61
" 14	Punahou St. ....	156	1	.64
" 15	Waikiki ....	400	0	.00
" 15	2425 Nuuanu St. ....	173	9	4.90
" 15	Puunui St. ....	74	2	2.60
" 15	Moana Hotel ....	250	0	.00
" 16	1516 Beretania St. ....	6	0	.00
" 16	Punahou College ....	48	3	5.90
" 16	Waikiki ....	110	1	.90
" 16	Nuuanu and Judd St. ....	62	4	6.10
" 16	Emma Street ....	60	3	4.70
" 16	Puunui St. ....	57	2	3.40
" 16	Asylum Lane ....	79	1	1.20
" 17	Moana Hotel ....	26	7	21.20
" 17	Pawaa Jct. ....	138	23	14.00
" 18	Georgia St. ....	12	2	14.30

Date of Larval Emerg- ence	Locality	Number of Specimens Bred		Percent- age of Parasit- ism
		C. Capi- tata	O. Humilis	
Sept. 19	2039 Nuuanu St. ....	125	7	5.30
" 19	Richards St. ....	403	39	8.59
" 19	1649 Nuuanu St. ....	34	6	15.00
" 19	Wyllie St. ....	24	1	4.00
" 21	130 Bates St. ....	122	1	.80
" 21	1914 Nuuanu St. ....	54	0	.00
" 21	Nuuanu Cemetery ....	8	1	11.10
" 21	412 Ninth Ave. ....	304	31	9.25
" 22	" " ....	356	4	1.10
" 22	Georgia St. ....	40	0	.00
" 22	Emma St. ....	32	3	8.50
" 23	2527 Liliha St. ....	4	1	20.00
" 23	Ainahau Hotel ....	65	2	2.90
" 24	412 Ninth Avenue ....	21	8	27.60
" 24	Ainahau Hotel ....	9	5	35.70
" 24	Auld Lane ....	8	2	20.00
" 24	Richard Street ....	5	4	44.00
" 25	Piikoi and Lunalilo Sts..	12	74	86.00
" 25	Pawaa Jct. ....	19	2	9.50
" 25	Auld Lane ....	10	7	41.20
" 25	Wyllie St. ....	1	4	80.00
" 25	2039 Nuuanu St. ....	13	1	7.10
" 25	St. Louis College ....	14	3	17.60
" 26	2039 Nuuanu St. ....	11	1	8.30
" 26	Punahou near Beretania	42	16	27.60
" 26	1917 Luso Street ....	32	2	5.90
" 26	Piikoi and Lunalilo ....	14	85	85.80
" 28	957 Prospect St. ....	14	3	17.65
" 28	Ainahau Hotel ....	75	5	6.20
" 28	2425 Nuuanu St. ....	12	5	29.40
" 29	Wyllie St. ....	18	1	5.20
" 29	1519 Beretania St. ....	11	2	15.40
" 30	Beretania and Kapiolani.	10	1	9.10
" 30	Kapahūla and Alapai Sts.	71	1	1.40
" 30	Ainahau Hotel ....	9	2	19.10







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### BOARD.

Reports of the Commissioner of Agriculture and Forestry for 1900 and 1902, and First Report of the Board of Commissioners of Agriculture and Forestry, 1904, are out of print.

Reports of the Board of Commissioners of Agriculture and Forestry for the years 1905, 1906, 1907, 1908, and biennial periods 1910, 1912, 1914.

"Notice to Importers," by H. E. Cooper; 4 pp.; 1903.

"Digest of the Statutes Relating to Importation of Soils, Plants, Fruits, Vegetables, etc., into the Territory of Hawaii." General Circular No. 1; 6 pp.

"Important Notice to Ship Owners, Fruit Importers and Other Rules and Regulations Prohibiting the Introduction of Certain Pests and Animals into the Territory of Hawaii." General Circular No. 2; 3 pp.; 1904.

"Laws and Regulations, Importation and Inspection of Honey Bees and Honey." General Circular No. 3; 7 pp.; 1908.

Act 71, Session Laws of 1905: "To Provide for the Protection of Forest Land Within the Territory from Fire." On Brush-burning Permit Form; 1905.

Act 104, Session Laws of 1907: "To provide for the Protection of Birds Beneficial to the Forests of the Territory of Hawaii." Unnumbered leaflet; 1907.

Pure Seed Law. Act 107, Session Laws of 1911: "To Regulate the Importation and Sale of Seed Into and Within the Territory of Hawaii." Unnumbered leaflet; 4 pp.; 1911.

"The Hawaiian Forester and Agriculturist," a monthly magazine. Vols. I to XI; 1904-1914. To be obtained from the Hawaiian Gazette Co., Honolulu, Hawaii. Price \$1 a year. (Issued under the auspices of the Board.)

### DIVISION OF FORESTRY.

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**Reports.**

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\*\* "Inspection of Imported Live Stock." Rule 1; 1 p.; 1905.

\* "Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis"; Rule 2; 1 p.; 1905.

\* "Concerning Glandered Horse Stock in the Territory." Rule 3; 1 p.; 1905.

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\* "Quarantine of Horse Stock from California." Rule 8; 1 p.; 1908.

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**DIVISION OF HYDROGRAPHY.**

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\*\* This Bulletin will be sent only to persons interested in the subject.

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